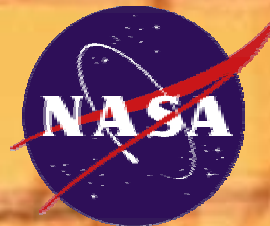




NASA Langley Research Center

Pollution Prevention Program Plan

CY 2002 Update



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NASA Langley Project Officer:

Bob Brown
Environmental Management Office
MS 418
NASA Langley Research Center
Hampton, VA 23681-2199

SAIC Project Manager:

Kristen Poultney
Science Applications International Corporation
MS 477
NASA Langley Research Center
Hampton, VA 23681-2199

NASA LaRC 2002 Pollution Prevention Plan

Table of Contents

Executive Summary	vi
1.0 Introduction.....	1-1
1.1 Purpose of P2 Plan	1-1
1.2 Description of CEMP and EO's and their relation	1-1
1.3 Description of NASA Langley Research Center	1-2
1.4 Plan Organization.....	1-3
2.0 Pollution Prevention Planning.....	2-1
2.1 Management Commitment	2-1
2.2 Project Identification System.....	2-1
2.2.1 Identification of Areas of Concern	2-1
2.2.2 Waste Management Hierarchy.....	2-2
2.3 Ranking of Pollution Prevention Projects.....	2-3
2.3.1 Methodology for Developing Ranking Criteria	2-4
2.3.2 Compliance Projects	2-4
2.3.3 Non-Compliance Projects	2-5
2.3.4 Other Ranking Criteria.....	2-5
2.4 Pollution Prevention Program Roles and Responsibilities	2-6
2.4.1 Environmental Management Office.....	2-6
2.4.2 Facility Environmental Coordinators.....	2-6
2.4.3 Personnel Serving As Heads of R&T Competency Areas, Program Offices, or Business Management Offices.....	2-6
2.4.4 Office of Logistic Management	2-7
2.4.5 All Personnel.....	2-7
2.5 Environmental Compliance Auditing	2-7
2.5.1 Process	2-7
2.5.2 Summary of Multimedia Audits.....	2-8
2.6 Training and Outreach	2-9
2.6.1 Environmental Courses	2-9
2.6.2 Environmental Website.....	2-10
3.0 Recycling and Affirmative Procurement.....	3-1
3.1 Recycling Program.....	3-1
3.2 Recycling Program Roles and Responsibilities	3-1
3.2.1 Environmental Management Office.....	3-1
3.2.2 Office of Logistic Management	3-2
3.2.3 Facility Environmental Coordinators.....	3-2
3.2.4 Center Employees and Contractors.....	3-2
3.3 Affirmative Procurement Program.....	3-3
3.4 Affirmative Procurement Roles and Responsibilities.....	3-3
3.4.1 Office of Procurement.....	3-3
3.4.2 Environmental Management Office.....	3-4
3.4.3 Systems Engineering Competency.....	3-5
3.4.4 Office of Logistics Management.....	3-5
3.4.5 Contracting Officers.....	3-5
3.4.6 Procurement Originators	3-6

4.0	Program Goals.....	4-1
4.1	Hazardous Material Usage	4-1
	4.1.1 Status on Hazardous Material Reduction.....	4-1
	4.1.2 Strategy for Hazardous Material Reduction	4-2
4.2	Hazardous Waste Management and Minimization	4-2
	4.2.1 Status on Hazardous Waste Management and Minimization	4-3
	4.2.2 Strategy for Hazardous Waste Management and Minimization	4-3
4.3	Alternative Fuel Vehicles	4-3
	4.3.1 Status on Petroleum Fuel Reduction.....	4-4
	4.3.2 Strategy for Petroleum Fuel Reduction.....	4-4
4.4	Solid Waste Generation and Diversion.....	4-4
	4.4.1 Status on Solid Waste Generation and Diversion	4-5
	4.4.2 Strategy for Solid Waste Generation and Diversion.....	4-5
4.5	Affirmative Procurement	4-6
	4.5.1 Status on Affirmative Procurement.....	4-6
	4.5.2 Strategy for Affirmative Procurement	4-7
4.6	Air Quality	4-7
	4.6.1 Status on Air Quality	4-7
	4.6.2 Strategy for Air Quality	4-8
4.7	Energy Conservation.....	4-8
	4.7.1 Status of Energy Conservation.....	4-8
	4.7.2 Strategy for Energy Conservation.....	4-9
4.8	Water Conservation.....	4-10
	4.8.1 Status of Water Conservation	4-10
	4.8.2 Strategy for Water Conservation	4-10
4.9	Award Program	4-10
	4.9.1 Status of Awards Program	4-11
	4.9.2 Strategy for Awards Program.....	4-11
4.10	Beneficial Landscaping.....	4-11
	4.10.1 Status of Beneficial Landscaping.....	4-12
	4.10.2 Strategy for Beneficial Landscaping.....	4-12

APPENDIX A - Pollution Prevention Accomplishments	A-1
Project No. 11 Oil/Water Separator Study	A-3
Project No. 14 Recycling Containers	A-3
Project No. 23 Recycling Incentive Program.....	A-3
Project No. 30 Contract Review.....	A-3
Project No. 31 Parts Washer Assessment	A-3
Project No. 51 Aerosol Usage and Alternatives Study	A-3
Project No. 52 Antifreeze Recycling Assessment.....	A-3
Project No. 58 Cardboard Recycling Study	A-3
Project No. 61 Reuse Facility.....	A-4
Project No. 67 Oil and Hydraulic Analysis Program	A-4
Project No. 70 Composting of Landscaping Waste	A-4
Project No. 77 Scrap Metal Recycling	A-4
Project No. 89 Alternative Fueled Vehicles.....	A-4
Project No. 94 Jet Fuel Reuse	A-4
Project No. 95 Aerosol Can Recycling	A-4

Project No. 98	Drum Acquisition and Recycling.....	A-4
Project No. 100	Propane Gas Cylinder Recycling	A-5
Project No. 102	Bulk Oil Purchase at Vehicle Maintenance	A-5
Project No. 105	Cardboard Reuse	A-5
Project No. 106	Water Conservation	A-5
Project No. 109	Digital Photography	A-5
Project No. 110	Rancid Machining Fluid Assessment.....	A-5
Project No. 112	P2 Facility Assessments.....	A-5
APPENDIX B - Pollution Prevention Active Projects		B-1
Project No. 1	Chemical Material Tracking System.....	B-3
Project No. 12	Recycling Plan Implementation	B-6
Project No. 13	Affirmative Procurement Implementation	B-9
Project No. 28	Training/Outreach Program	B-12
Project No. 32	Hazardous Materials Usage Analysis	B-15
Project No. 55	Paint and Coatings Study	B-18
Project No. 64	Air Pollution Prevention	B-21
Project No. 73	Alternatives to CFC Cleaning of Oxygen Systems.....	B-24
APPENDIX C - Pollution Prevention Identified Projects		C-1
Project No. 21	Storm Water Management	C-3
Project No. 29	Energy Conservation.....	C-3
Project No. 50	Paper and Cloth Towel Assessment.....	C-3
Project No. 111	On-Line Training Development.....	C-3
Project No. 114	Beneficial Landscaping.....	C-3
Project No. 115	1229A Rinsewater Recycling.....	C-3
APPENDIX D - Pollution Prevention Completed Projects		D-1
Project No. 2	Oil Usage Study	D-5
Project No. 3	Electroplating Assessment	D-5
Project No. 4	Common Solvents Management	D-5
Project No. 5	Standard Operating Procedures.....	D-5
Project No. 6	Towpreg Study	D-5
Project No. 7	Waste Segregation SOP	D-5
Project No. 8	Photoprocessing Assessment	D-5
Project No. 9	Environmental Coordinators	D-5
Project No. 10	Promotional Program/Awareness	D-5
Project No. 15	Solid Waste Source Reduction.....	D-5
Project No. 16	Lab Pollution Prevention Training.....	D-5
Project No. 17	Alumina Study	D-5
Project No. 18	Commodities Exchange Program.....	D-6
Project No. 19	Silver Recovery Assessment	D-6
Project No. 20	Ground Maintenance SOP	D-6
Project No. 22	Memo Strategy	D-6
Project No. 24	General Wind Study Training.....	D-6
Project No. 25	Storage Tank Study	D-6
Project No. 26	Cooling Tower Assessment	D-6
Project No. 27	Chemical Exchange.....	D-6
Project No. 33	HAZMAT Cabinet Identification.....	D-6

Project No. 34	Receiving/Loading Dock Staff Training.....	D-7
Project No. 35	Building 1244 Assessment.....	D-7
Project No. 36	Cutting Fluid Recycling Assessment.....	D-7
Project No. 37	Guidelines for Erosion and Sediment Controls.....	D-7
Project No. 38	Material Review.....	D-7
Project No. 39	Wildlife Study.....	D-7
Project No. 40	New Building Energy Efficiency Standards.....	D-7
Project No. 41	Alternative Transportation Assessment.....	D-7
Project No. 42	Absorbents Study.....	D-7
Project No. 43	Common Cleaning Solvents Study.....	D-7
Project No. 44	Print Shop Assessment.....	D-8
Project No. 45	Solid Waste Management Training.....	D-8
Project No. 46	Environmental Labeling Program.....	D-8
Project No. 47	Vehicle Maintenance Assessment.....	D-8
Project No. 48	DRMO Quick Delivery Study.....	D-8
Project No. 49	Wash Water Recycling Assessment.....	D-8
Project No. 53	Cafeteria Study.....	D-8
Project No. 54	Energy/Water Usage Study.....	D-8
Project No. 56	Fyrquel Study.....	D-8
Project No. 57	Oil Compressor Study.....	D-8
Project No. 60	Gas Cylinder Tracking Program.....	D-8
Project No. 62	EPCRA 313 TRI Chemical Reduction.....	D-9
Project No. 63	Pollution Prevention Support Building.....	D-9
Project No. 65	Electrowinning at the Electroplating Shop.....	D-9
Project No. 66	Automation of Technical Library Reproduction Facility.....	D-9
Project No. 68	Hydraulic Fluid Analysis Program.....	D-9
Project No. 69	Material Substitution for HAPs.....	D-9
Project No. 71	Model Office for Affirmative Procurement.....	D-9
Project No. 72	Environmental Coordinators Database.....	D-9
Project No. 74	Solvent Distillation Implementation.....	D-9
Project No. 75	Magnetic Drum Separation.....	D-9
Project No. 76	Double-sided Copiers.....	D-9
Project No. 79	Glycol Ether Substitution.....	D-9
Project No. 80	Methyl Ethyl Ketone Alternatives.....	D-10
Project No. 81	Ethylene Glycol Alternatives.....	D-10
Project No. 82	Toluene Alternatives.....	D-10
Project No. 83	Methylene Chloride Alternatives.....	D-10
Project No. 84	Paint Stripper Alternative.....	D-10
Project No. 85	Varsol Alternatives.....	D-10
Project No. 86	Various HAP Alternatives.....	D-10
Project No. 87	Low Mercury Fluorescent Tube Program.....	D-10
Project No. 88	Chip Wringer Assessment.....	D-10
Project No. 90	Building 1225 Assessment.....	D-10
Project No. 91	Paper Baler Loading System Assessment.....	D-11
Project No. 92	Lubricant Filtration System.....	D-11
Project No. 93	Operating Procedures for Specific Cases.....	D-11
Project No. 96	Jet Fuel Containment Pad.....	D-11
Project No. 99	Boiler Modifications at the Steam Plant.....	D-11
Project No. 101	Paint Gun Washer Assessment and Implementation.....	D-11
Project No. 103	Depainting of Aircraft Wheels.....	D-11

Project No. 104 CFC Conversions	D-11
Project No. 107 Car Wash Assessment.....	D-11
Project No. 108 Assessment of Sealed Batteries	D-11
Project No. 113 Outfall No. 009 Assessment.....	D-12
APPENDIX E - Pollution Prevention Baseline Data.....	E-1
1.0 Hazardous Materials	E-3
2.0 Hazardous Waste.....	E-5
3.0 Non-Hazardous Waste	E-14
4.0 Recycling and Solid Waste Program.....	E-23
5.0 Affirmative Procurement	E-25
6.0 Water Consumption	E-27
7.0 Energy Program.....	E-28
8.0 Air Emissions.....	E-29
APPENDIX F - Environmental Audit Program.....	F-1
APPENDIX G - Draft List of Priority Chemicals	G-1
APPENDIX H - Environmental Regulations and Policies	H-1
APPENDIX I - Program Contacts	I-1
APPENDIX J - References	J-1

NASA LaRC 2001 Pollution Prevention Plan Executive Summary

LaRC developed a Pollution Prevention Plan in 1992 and has been implementing a Center-wide pollution prevention program since that date. LaRC's upper management has endorsed the NASA LaRC pollution prevention program through the statement of policy. This commitment conveys to all LaRC personnel, both civil servant and contractor, the importance that upper management attributes to the pollution prevention program and its desire to promote progress.

Pollution prevention concepts are integrated throughout the environmental program: compliance, restoration, and conservation. Pollution prevention is used as a proactive management approach to achieving or exceeding compliance with environmental laws. This proactive approach greatly reduces compliance concerns, overall compliance costs, and long-term environmental liability.

LaRC's pollution prevention program continues to be very successful. Through process changes, improved management practices and material substitutions, the P2 program eliminated use of reportable Toxic Release Inventory chemicals, reduced or eliminated environmentally harmful chemicals and processes, and improved overall compliance with environmental requirements. FY01 data indicates that Pollution Prevention initiatives avoided \$91,698 in costs for 2001. Over the past seven years the Center's hazardous waste disposal costs have significantly decreased from \$200,000 in 1993, to approximately \$50,000 in 2001. There has been a corresponding decrease in hazardous waste disposal volume, from over 300,000 pounds in 1993 to 53,017 pounds in 2001. The declining wastes and costs are due, in large part, to pollution prevention initiatives. Additional benefits of the prevention program are reduced operating costs, improved compliance, lessened impact to the environment and improved worker health and safety.

The Pollution Prevention Plan has been updated annually since 1994. This CY 2002 Plan contains the blueprint for the pollution prevention program to be implemented in calendar year 2002 and incorporates EMO goals for FY02. The EMO tracks the Center's progress towards achieving the goals in a monthly P2 Progress Report. Many of the different environmental media areas have common strategies for achieving the Center's program goals such as:

- Increase employee awareness through training and outreach. (see Section 2.6)
- Maximize the use of the Center's Chemical Material Tracking System (CMTS) and maintain accurate chemical inventories. (see Project No. 1)
- Conduct multimedia environmental assessments of Center facilities to identify pollution prevention opportunities and keep abreast of Center operations. (see Section 2.5)
- Use the NASA Environmental Tracking System (NETS) to track and evaluate environmental program data.

In addition to describing the Center's P2 goals, this Plan includes new P2 projects, chronicles the status of existing projects, and documents changes in Center activities, waste patterns and raw material usage. This and previous Plans were developed following the principals and steps described in the *NASA Pollution Prevention Program Guidance Manual*.

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1.0 Introduction

1.1 Purpose of Pollution Prevention Plan

This document is the NASA Langley Research Center Pollution Prevention Plan. The Plan fulfills and exceeds the requirements contained in Executive Order 13148 and the Resource Conservation and Recovery Act (RCRA). Executive Order 13148 requires Federal facilities to prepare written pollution prevention plans and develop goals to reduce the use and release of toxic chemicals. RCRA Sections 3002(b) and 3002(h) require a hazardous waste minimization plan. The NASA LaRC Pollution Prevention Plan serves as the planning document to record baseline data, describe reporting procedures, track projects for achieving targets, and measure performance for those objectives. Specifically, the Plan addresses the pollution prevention goals established by LaRC and goals within the Greening the Government Executive Orders. *NASA LaRC does not endorse any of the vendors or products that may be listed in the Plan, but rather, they are included for information purposes only.*

1.2 Relationship Between the Code of Environmental Management Principles, Environmental Management Systems, and the Greening the Government Executive Orders

Executive Order 13148, “Greening the Government Through Leadership in Environmental Management” requires all federal agencies and their facilities to develop environmental management systems (EMS) by December 31, 2005. The purpose of an EMS is to help agencies and facilities integrate environmental accountability into day-to-day decision making and long term planning processes for all missions, activities, and functions. Each agency must adopt a particular EMS “framework” that governs the objectives and elements of the EMS. Examples of EMS frameworks include ISO 14001, the American Chemistry Council’s Responsible Care program, and the International Chamber of Commerce’s Business Charter for Sustainable Development.

The U.S. Environmental Protection Agency (EPA) prepared the Code of Environmental Management Principles (CEMP) for federal agencies in response to Executive Order (EO) 12856, “Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements”. The principles in the CEMP provide a framework for federal agencies and facilities to develop EMS’s. The five main elements of the CEMP follow.

1. Management Commitment
2. Compliance Assurance and Pollution Prevention
3. Enabling Systems
4. Performance and Accountability
5. Measurement and Improvement

These elements are the framework upon which a facility can build a successful EMS. Part of the CEMP framework is the development of performance goals and measurement of those goals. The Greening the Government Executive Orders provide NASA with guidance on the types of environmental issues that NASA should address with its EMS. These include affirmative procurement, recycling, energy conservation, water conservation, landscaping practices, economic analysis of projects, and many other areas. NASA can use each of these issues to set specific measurable goals that will help NASA Centers improve their environmental performance.

NASA endorsed the EPA's CEMP on September 30, 1996 as their formal Environmental Management Systems (EMS) standard. The CEMP is a reference document in NASA's draft EMS NPG 8853, expected to be completed and signed this fiscal year. Copies of CEMP endorsement letter can be obtained through NASA Headquarters.

1.3 Description of NASA Langley Research Center

NASA Langley Research Center (LaRC) is located in Hampton, Virginia and occupies 807 acres of government-owned land adjacent to several surface water bodies within the tidal zone of the Chesapeake Bay. The West Area consists of 787 acres, bound by Brick Kiln Creek to the north, Route 172 to the west, and Langley Air Force Base on the south and east. The East Area, consisting of 20 acres, is completely located within Langley Air Force Base. There are approximately 234 permanent buildings, in addition to varying numbers of power stations and trailers, divided between the East and West Areas. Overview maps of the LaRC West and East areas are presented in Exhibits 1.1 and 1.2.

The mission of the Center is to increase the knowledge and capability of the United States in the field of aeronautical research and in selected areas of space research. This mission is accomplished by performing innovative research relevant to national needs and Agency goals, transferring technology to users in a timely manner, and providing development support to other United States Government agencies, industry, and other NASA centers.

Approximately 70 percent of the work performed at LaRC involves aeronautical research. The research includes improving today's aircraft and developing concepts and technology for aircraft of the future. The aeronautical research goals of the Center are to: (1) develop technologies to make aircraft fly faster, farther, and safer, and (2) to enable these aircraft to be more maneuverable, quieter, less expensive, and more energy-efficient. LaRC uses wind tunnels, computer modeling, and other facilities and techniques to conduct tests and perform research on aircraft. The aircraft research is utilized in the range from low-speed general aviation and transport aircraft to high-speed hypersonic aircraft.

The remaining 30 percent of the work at LaRC supports national space programs. Researchers identify and develop technology for advanced Space Transportation Systems, conduct conceptual design activities for large space systems and space station technology, and conduct studies in Atmospheric and Earth sciences. LaRC space researchers also study composite materials, structures, thermal guidance control systems, electronic systems, and robotics.

To fulfill its mission, LaRC employs approximately 3,770 individuals, including administrators, researchers, technicians, maintenance staff, and service contractors. The Office of the Director manages eight Program Areas and one Agency Function, six Research and Technology Competencies and thirteen Business Management Offices. Each directorate performs research or support activities related to the overall LaRC mission.

The aeronautical and space research missions at LaRC require large-scale physics and chemistry research, engineering and design testing, and equipment maintenance. In turn, these activities and operations are responsible for generating by-product chemical wastes and chemical emissions to the land, water, and air, as well as contributing to the region's non-point source pollution problems in the Chesapeake Bay watershed.

1.4 Plan Organization

The NASA LaRC P2 Plan is an environmental strategy for reducing waste generation and minimizing the environmental impacts caused by facility operations at the Center. The Plan is organized into four sections, with ten appendices. Section 1 is an introduction to NASA LaRC and its P2 Plan. Section 2 details NASA LaRC's strategy for a successful P2 program by explaining the program identification and ranking system, roles and responsibilities, auditing, and the training and outreach program. Section 3 discusses NASA LaRC's Recycling and Affirmative Procurement Programs. Section 4 outlines NASA LaRC's 2002 P2 goals for its environmental program areas.

The bulk of the technical information concerning pollution prevention projects is contained in tables, charts and text found in Appendices A-E. Appendix A is a compilation of Pollution Prevention Accomplishment projects at NASA Langley Research Center. Appendix B contains project descriptions of active projects or projects that are in the process of being implemented. Appendix C lists projects that have been identified but not yet implemented. Appendix D lists projects that have been completed or discontinued because the project is no longer applicable or because more specific projects are being implemented. Appendix E provides detailed baseline data for P2 goals and objectives described in Section 4. Appendix F provides the checklist and FY00 metric data for the Center's Environmental Audit Program. Appendix G lists proposed chemicals targeted for reduction by the EPA, including possible chemical alternatives. Appendix H provides the governing Federal, state, local and NASA regulations and policies for the environmental program. EMO program area contacts are provided in Appendix I. Additional document reference information is given in Appendix J.

A B C D E



E F G H



LANGLEY RESEARCH CENTER
EAST AREA



250 0 250 500 750 Feet

1-6

2002 Update

2.0 Pollution Prevention Planning and Implementation

2.1 Management Commitment

Management commitment is essential to the overall success of the Program Plan. LaRC demonstrates management commitment through pollution prevention activities and continuous improvement for all Center research and support activities. LaRC managers and Center personnel are trained in pollution prevention concepts and given incentives to promote pollution prevention. LaRC also earmarks funds for pollution prevention studies, equipment purchases, and training.

2.2 Project Identification System

A successful pollution prevention program relies on specific projects to integrate the concepts of pollution prevention into LaRC's mission. Thus, a principal goal of the LaRC pollution prevention program is to develop an atmosphere where there is a Center-wide commitment to routinely consider pollution prevention options as a part of doing one's job. The best way to achieve this goal is to demonstrate the benefits of pollution prevention to individual LaRC employees through the selection and implementation of visible, efficient pollution prevention projects. The steps involved in developing effective pollution prevention projects are to:

- Identify areas of concern where pollution prevention techniques may be applied;
- Determine the pollution prevention options which are best suited for each area of concern;
- Use the pollution prevention options to develop specific pollution prevention projects;
- Rank the projects relative to others using specific criteria; and
- Implement the highest-ranking projects first.

2.2.1 Identification of Areas of Concern

One of the most significant objectives of LaRC's pollution prevention program is to analyze current and past operating practices. To fulfill this objective, the program identifies environmental concerns and proposes solutions to them in the form of pollution prevention projects. Appendix E provides baseline data for environmental media areas and an analysis including program and Center operation changes. Section 2.5.2 details common environmental concerns found during multi-media audits. Section 4 provides the strategy and status to meet Executive Order and Center P2 goals.

The data is used to determine which practices and facilities present the greatest opportunity for pollution prevention initiatives. This determination is made by quantifying, where possible, the volume of materials consumed, the volume of waste produced, the nature of the materials and waste in question, the cost of waste management and the process or facility's potential impact on the environment or compliance status. As an example, waste oil generation at LaRC and associated costs were investigated and pollution prevention opportunities were identified and implemented. The Oil and Hydraulic Analysis Program is a proactive approach to maintaining the Center's mechanical equipment (see Project No. 67). Oil and water separation (see Project No. 11) reduces waste and disposal costs. Best management practices are used to extend the life of coolants (see Project No. 110).

2.2.2 Waste Management Hierarchy

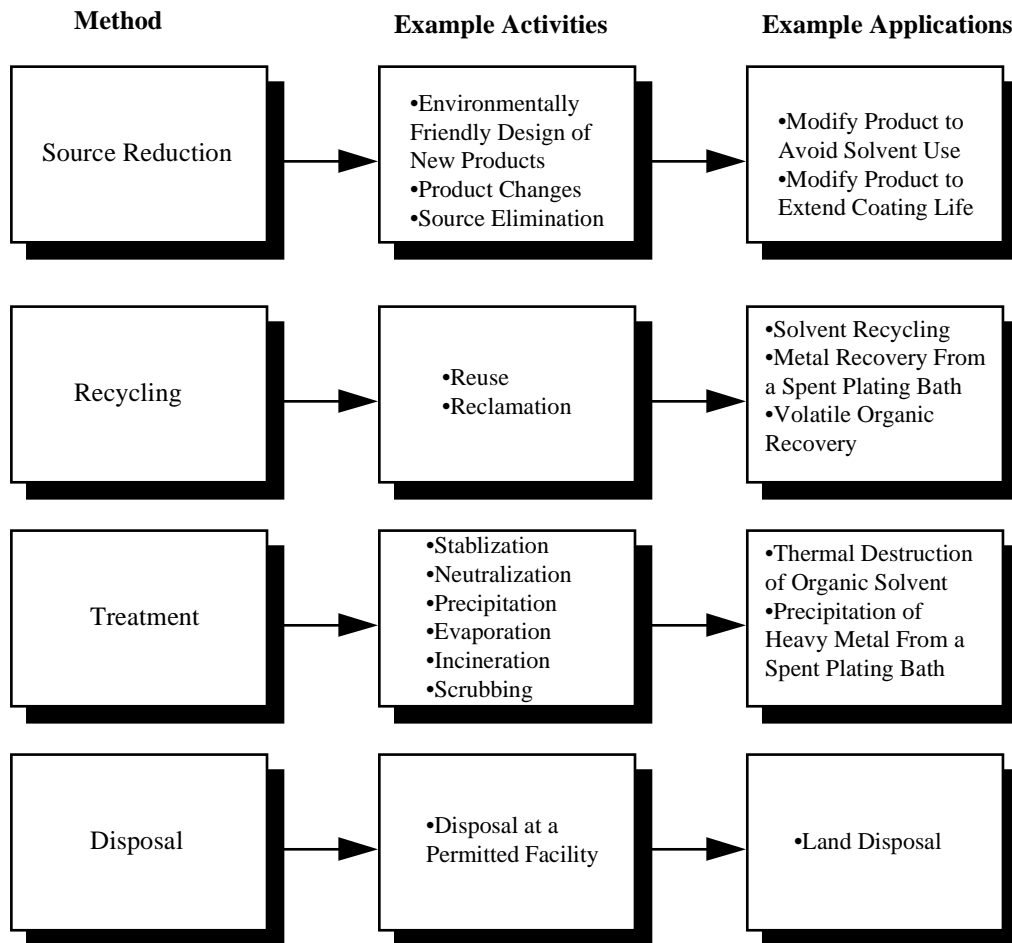
The Waste Management Hierarchy, discussed in the Pollution Prevention Act of 1990, is used at LaRC as a conceptual framework to identify and rank pollution prevention projects. This hierarchy presents environmental management techniques to reduce and eliminate adverse environmental impacts. As illustrated in Exhibit 2.1, source reduction is given the highest priority. When source reduction cannot be implemented, recycling is preferred over treatment and disposal. Treatment and disposal is only considered as a last resort, after all other options have been exhausted. Below defines the components of the pollution prevention hierarchy.

- Source reduction is the use of materials, processes, or practices that reduce or eliminate the quantity and toxicity of wastes at the source of generation. Source reduction is a multimedia approach that minimizes or eliminates waste released to land, air, and water. Source reduction opportunities include practices such as raw material substitutions, improved and proactive operating practices, and technological changes to either processes and/or equipment.
- Recycling refers to the reuse or regeneration of materials and wastes into usable products and by-products. It also includes the reclamation of products that are no longer in use (e.g., outdated equipment or unused raw materials). Recycling includes practices such as on-site or off-site recycling, materials exchange or reuse, and recovery of materials.
- Treatment refers to the practice of changing the form or composition of a waste stream through a controlled reaction. LaRC is not permitted to perform any on-site treatment of hazardous waste. Some treatment technologies include neutralization, stabilization, oxidation, or incineration of wastes. While treatment technologies have been designed to lessen the hazard and/or volume of waste prior to ultimate disposal, there still exist some hazardous by-products that could affect the environment within another media area. Shipping waste off-site for treatment is only considered if source reduction and recycling are not possible.
- Disposal should be considered only when all other options are exhausted. Disposal is considered the least favored method because of the high costs associated with disposal. Permitted Transfer, Storage and Disposal Facilities (TSDFs) are used for disposing of hazardous material and many of these sites are approaching capacity. In addition, there are hazards associated with the transportation of wastes and additional administrative requirements associated with the disposal (i.e., hazardous waste manifests and record keeping).

Implementation of source reduction measures reduces the possibility of toxic emissions to the environment and/or costs associated with operation, maintenance and waste management. Costs that may be reduced include costs for raw materials, waste disposal, transportation, handling and storage, training, management overhead (e.g., paperwork), and emergency response. Future costs, such as remediation activities, can also be avoided with source reduction activities.

In addition, source reduction produces positive health and environmental benefits. Minimizing the use of hazardous materials creates a safer workplace and reduces the need for health and safety protection devices and garments. A safer workplace will also contribute to employee satisfaction.

Exhibit 2-1 Waste Management Hierarchy



2.3 Ranking of Pollution Prevention Projects

To integrate identified pollution projects into a coherent pollution prevention program, each project is ranked relative to the other projects using consistent, well-defined criteria. The criteria used to rank pollution prevention projects were selected based on Center needs and requirements. The criteria are liability, mission impact, cost, environmental benefits, ease of implementation, level of effort, and whether a project builds environmental infrastructure.

Included in the appendices are the pollution prevention projects from the original 1992 Pollution Prevention Plan to projects identified as recently as September 2001. The projects are organized into four appendices. Appendix A lists project accomplishments where implementation has been completed but the progress continues to be tracked to determine the status of achieving Executive Order and Center goals. Appendix B describes active projects that are being implemented and continuously evaluated for improvement opportunities. Appendix C lists projects that have been identified for implementation in order to assist with achieving Executive Order and Center goals. Appendix D lists projects that have been completed and/or discontinued. Many of the Appendix D projects have been superceded or incorporated into more specific projects.

The final ranking of pollution prevention projects are presented in tables in Appendices A-D to suggest relative priorities and are used as a tool to select proposed projects. The projects are listed in descending order based on the total score. However, the ranking does not necessarily dictate an order for implementation. Over time, the relative priorities of these projects will change, thus the results presented are for planning purposes only.

2.3.1 Methodology for Developing Ranking Criteria

Individual criteria were assigned points based on varying scales for compliance issues and pollution prevention ("non-compliance") issues. Each project was evaluated based on a weighted sum method. A summary of all pollution prevention projects and their corresponding scores is provided in Appendices A-D.

The projects are divided into two categories: Compliance Projects and Non-Compliance Projects. Compliance Projects are related to current or potential compliance issues. These projects are most important to the current LaRC environmental program due to the escalating costs and liability associated with non-compliance. Non-Compliance Projects are projects that did not have associated compliance issues. The designation "non-compliance" does not mean that LaRC is out of compliance with respect to environmental regulations.

2.3.2 Compliance Projects

Because of the increasing number and more stringent nature of environmental regulations, noncompliance is of significant consequence. Thus, for pollution prevention projects related to a compliance issue, the compliance criterion was ranked the highest. Projects with a high compliance score help resolve a current compliance issue or lower the potential for future compliance concerns. An example of this "compliance through pollution prevention" approach is solvent-based parts washers, permitted air sources, which are replaced with closed-loop aqueous-based parts washers (see Project No. 31).

Liability is the second most important factor in ranking compliance projects. Since the passage of the Federal Resource Conservation and Recovery Act (RCRA) and the Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), waste producers have been subject to the possibility of unlimited liability for any harm caused by their wastes. If the project indicated a decrease in future liability, it was given a higher score.

The third most significant criterion for compliance projects is mission impact. LaRC's goal is to integrate pollution prevention into LaRC's mission without interrupting research activities. In some cases, projects may interrupt a facility's operation, be burdensome to staff, or require funding from LaRC's budget. Positive mission impacts may also occur. For example, projects may result in increased efficiency. A high score for this criterion indicates a positive affect on LaRC's mission.

Cost is the next criterion considered by the assessment team. Costs are broken down into investment costs and potential cost savings. Investment costs refer to the amount of money that is required to implement the pollution prevention project. Cost savings are potential future savings, such as reduced hazardous waste disposal costs or reduced operating costs. Cost savings may also result from generating revenues from recycling efforts and the resale of excess materials.

The final criterion for compliance-related issues is the potential environmental benefits gained from implementation of the project. Environmental benefits may include reduced emissions, reduced impact on natural resources, decreased hazardous material usage and waste, etc.

The range of values assigned to each of the criteria is listed in Table 2-1.

Table 2-1
Criteria Values Used to Evaluate Compliance Projects

Criteria	Value
Compliance (C)	0 - 100
Liability (Liab)	0 - 50
Mission Impact (MI)	0 - 40
Cost	0 - 30
Environmental Benefits (Env Ben)	0 - 20

2.3.3 Non-Compliance Projects

Non-Compliance criterion is the first and foremost criterion in the ranking scheme for Non-Compliance Projects. Such projects are not directly related to regulatory compliance and are rated on their potential to prevent pollution. Higher scores indicate that the project is a good candidate for implementation. The remaining criteria are mission impact, costs, environmental benefits, and liability. These are defined as the same as compliance projects. The only difference is the priority and range of values assigned to each criterion. The range of values for each criterion is listed in Table 2-2.

Table 2-2
Criteria Values Used to Rank Non-Compliance Projects

Criteria	Value
Non-Compliance (N/C)	0 - 50
Mission Impact (MI)	0 - 50
Cost	0 - 40
Environmental Benefit (Env Ben)	0 - 30
Liability (Liab)	0 - 20

2.3.4 Other Ranking Criteria

For both Compliance and Non-Compliance Projects, three additional criteria were applied. These other criteria give a higher ranking to projects that are considered "low hanging fruit" -- those projects that can be implemented easily and quickly. If a realistic set of projects can be implemented and show immediate results, the pollution prevention concept can be integrated much more effortlessly into LaRC's daily activities.

The first additional criterion is "ease of implementation", referring to whether a project is easy to implement. For example, if a project entails conducting a basic paper study, it will get high points for "ease of implementation".

"Level of effort" is the second additional criterion. It refers to the number of staff and contractor hours required to implement the project. A project that employs only a few staff members will be preferred over a project that will require a more labor-intensive effort.

The final additional criterion is "builds environmental infrastructure". For example, projects that promote employee training and outreach help build LaRC's environmental infrastructure. New staff positions and committees that assist the EMO also build the infrastructure.

2.4 Pollution Prevention Roles and Responsibilities

The Environmental Management Office (EMO) is the proponent for the LaRC pollution prevention program. The EMO is responsible for planning, budgeting, monitoring, and guiding the overall effort. Implementation of the program, however, is a shared responsibility of all Center personnel. LaRC is committed to identifying and implementing pollution prevention opportunities through active involvement of all employees. Below are the specific pollution prevention responsibilities for key offices and personnel at LaRC in order to comply with the Center's policy and succeed in protecting the environment. Responsibilities specified in the Center's environmental policy document, the Environmental Program Manual (LAPG 8800.1) follow.

2.4.1 Environmental Management Office (EMO)

- Understand the requirements of E.O. 13148 and the objectives of the NPG 8820.3.
- Update the LaRC Pollution Prevention Plan annually.
- Prepare and submit the annual pollution prevention progress report to NASA Headquarters.
- Review LaRC specifications and standards and, where possible, recommend reducing the acquisition and use of products containing extremely hazardous substances.
- Prepare metrics to document the Center's pollution prevention activities.
- Conduct pollution prevention opportunity assessments and recommend implementation of projects as appropriate.
- Request funding to support pollution prevention activities.
- Provide pollution prevention training.

2.4.2 Facility Environmental Coordinators

- Understand the requirements of E.O. 13148 and the objectives of the NPG 8820.3.
- Minimize the volume and toxicity of waste generated by their facilities to the extent technically possible and economically feasible.
- Propose operations or projects for pollution prevention opportunity assessments.
- Schedule training to familiarize personnel with pollution prevention practices.
- Participate with the EMO in conducting pollution prevention opportunity assessments.
- Develop and implement pollution prevention projects.
- Provide the EMO with data to evaluate the effectiveness of pollution prevention projects.

2.4.3 Personnel serving as the Heads of R&T Competency Areas, Program Offices or Business Management Offices shall:

- Understand the requirements of E.O. 13148 and the objectives of the NPG 8820.3.
- Support all personnel participating in pollution prevention projects.
- Utilize pollution prevention concepts in operation and management activities.

2.4.4 Office of Logistics Management (OLM)

- Understand the requirements of E.O. 13148 and the objectives of the NPG 8820.3.
- Identify markets for recycled materials.
- Advise the EMO of property disposal and resale requirements.
- Provide the EMO with data to evaluate the effectiveness of pollution prevention projects.

2.4.5 All Personnel

- Understand the requirements of E.O. 13148 and the objectives of the NPG 8820.3.
- Participate in the pollution prevention program.
- Attend pollution prevention training courses at their facilities.
- Propose pollution prevention projects.
- Minimize the volume and toxicity of waste generated by their facilities to the extent technically possible and economically feasible.

2.5 Environmental Compliance Auditing

Environmental multimedia compliance audits are performed at various buildings and laboratories throughout the Center. The multimedia audits are intended to ensure compliance with Federal or state environmental regulations, Center environmental policy, identify new P2 and training opportunities, establish an environmental profile of each building, and to provide information to FEC's on environmental policies and procedures. Below is a description of the multimedia compliance audit process.

2.5.1 Process

An on-site environmental contractor conducts the environmental multimedia compliance audits for the Environmental Management Office (EMO). The compliance assessment process is broken down into five basic steps.

1. The multi-media audit is scheduled with the Facility Environmental Coordinator (FEC). The FEC is sent the multi-media audit checklist that will be used to conduct the audit. Appendix F contains the multi-media audit checklist.
2. The first part of the actual audit is a discussion with the FEC about facility operations, using the multi-media audit checklist as guidance. The audit team and the FEC perform a walk-through audit of the facility's operations to ensure compliance in addition to providing guidance for best management practices.
3. The EMO staff is promptly notified of any non-compliance issues. In cases of non-compliance issues that pose an immediate threat to the environment or personnel, the EMO will take necessary action, including issuing a cease and desist order to resolve the problem and bring the Center back into compliance.
4. The audit checklist identifies any non-compliance issues, recommendations, and comments. The completed checklist is reviewed by the EMO prior to being sent to the FEC. If the facility receives any non-compliance findings, the FEC has thirty days to respond to EMO with how the non-compliance issues have been resolved or a correction action plan if more time is needed.

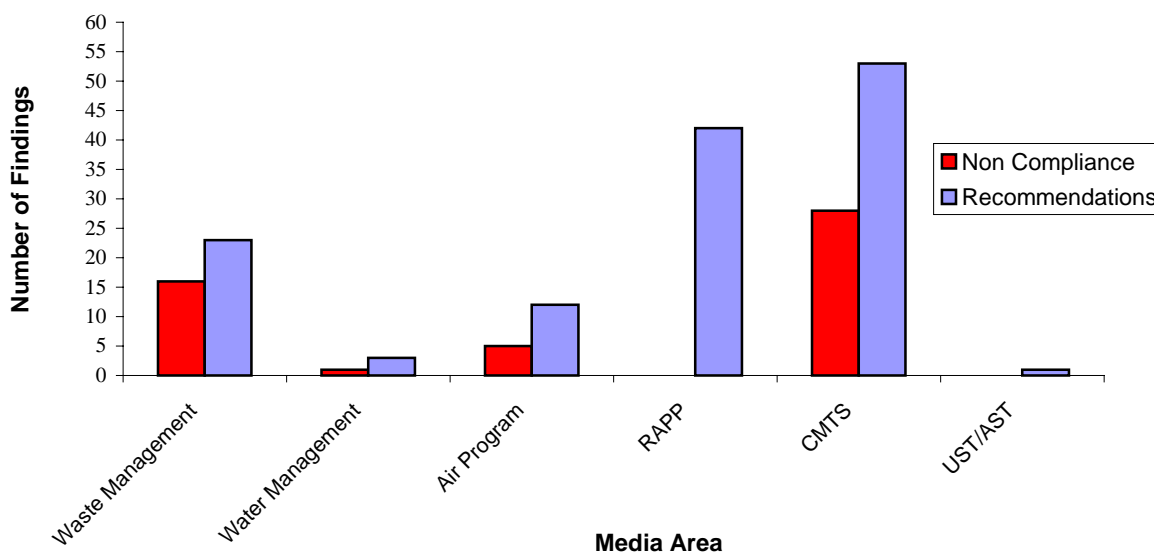
5. If a facility fails to take action within the 30-day response deadline, the EMO will notify the facility's Operational Unit Manager (OUM). The OUM will be asked to intervene and help solve non-compliance issues.

2.5.2 Summary of Multimedia Audits Conducted

In FY01, there were forty-two multimedia audits conducted throughout the Center. Appendix F summarizes the audits and also indicates the number of findings and recommendations the facility received in each environmental media area. If a facility receives a non-compliance finding, it indicates that the facility is not compliant with Federal, state, or local regulations, or a Center policy that could result in a Notice of Violation or enforcement action. If a facility receives a recommendation, it indicates that the facility is not compliant with NASA policies or suggests a best management practice could be implemented.

Exhibit 2-2 presents a graphical representation of findings by media areas. There were a total of 50 non-compliance findings and 134 recommendations on the audits conducted during FY01. Listed below is a brief description of the common findings and recommendations by media area.

Exhibit 2-2
Multimedia Compliance Audits



- Waste Management: There were sixteen non-compliance findings and twenty-three recommendations made in the waste management program. The majority of the findings were due to improper management of Satellite Accumulation Areas (SAA's) such as containers not being properly labeled or not performing weekly inspections of the SAA. The recommendations included having an updated spill plan, additional spill material, or providing the web address for the new weekly inspection log sheet.
- Water Management: There was one non-compliance finding and three recommendations made in the water management program. The non-compliance finding was a result of an illegal water

discharge that violated LaRC's Hampton Roads Sanitation District (HRSD) permit. Recommendations were given to remind personnel to notify EMO prior to the installation of new equipment that could possibly impose permitting requirements.

- Air Program: There were five non-compliance findings and twelve recommendations made in the air program. The non-compliance findings were due to the operation of air pollution sources that were not identified on the Virginia Department of Environmental Quality (VADEQ) air-operating permit. Recommendations included posting the air permit, ensuring adequate equipment maintenance, and reminding personnel to notify EMO prior to the installation of new equipment.
- RAPP: There were forty-two recommendations given to ensure personnel responsible for ordering supplies for the facility are given the list of EPA designated items.
- CMTS: There were twenty-eight non-compliance findings and fifty-three recommendations made in CMTS. The majority of non-compliance findings were a result of facilities not using CMTS or improperly entering cylinders and bulk tanks in CMTS. The recommendations were mainly comprised of facilities that needed to add MSDS's to inventory records.
- UST/AST: There was one recommendation made in the area of UST/AST. This recommendation was to have the facility perform the leak detection test on the USTs on a monthly basis.

2.6 Training and Outreach

Employee outreach and training raises environmental awareness and informs staff of their responsibilities in order to ensure environmental compliance and improve environmental stewardship. Outreach and training empowers and motivates staff to identify and implement pollution prevention projects and strengthens LaRC's environmental and pollution prevention program.

2.6.1 Environmental Courses

The Environmental Management Office conducts environmental training. This training covers a broad range of environmental issues and topics and sets forth policy, responsibilities, procedures, and environmental standards for implementation of the Environmental Program at the Center. The EMO conducts four main categories of training at LaRC:

- Facility Environmental Coordinator (FEC) Training
- Senior Management Training
- Waste Management Training
- Environmental Awareness Training

The FEC, Senior Management Training, and Waste Management Training are mandatory annual training courses. The Environmental Awareness Training addresses a variety of environmental topics including:

- Affirmative Procurement
- Air Compliance
- CMTS/Form 44
- Pollution Prevention
- Recycling
- LaRC's Environmental Program

In addition, the Environmental Management Office (EMO) has a variety of activities to achieve environmental outreach. The EMO website allows Center personnel to access information on background, procedures, updates, and metrics of environmental program areas at the Center. On a monthly basis, EMO electronically distributes the Environmental Insight Newsletter and submits an environmental article to LaRC's biweekly Researcher News publication. LaRC also participates in local and national conferences and events, such as Earth Fest, in order to share LaRC's environmental experiences.

2.6.2 Environmental Web Site

The Environmental Management Office's (EMO) Web site (<http://osemant1.larc.nasa.gov/>) provides quick and easy access to information and services on environmental issues for Center personnel. The EMO website is comprised of the four main sections briefly described below.

About EMO

This section provides the Mission Statement of the Environmental Management Office, the areas of responsibility, program contacts and the sitemap.

Environmental Program Information

Currently, there are links to the Recycling Program, Pollution Prevention Program, the Affirmative Procurement Program, Waste Management Program, the Air Pollution Management Program, and the Environmental Program Metrics for EMO.

- **Pollution Prevention**
This site contains information on the pollution prevention program, provides a listing of pollution prevention projects, and highlights some of the P2 projects at the Center. This site will also provide links to the Beneficial Landscaping web page.
- **Recycling and Affirmative Procurement Programs**
These Web pages give access to information on the types of items that are recycled as well as their recycling instructions and general information about affirmative procurement and how it applies to LaRC. A description of procurement pilot projects, a list of items that the Center must buy with recycled content, and access to the justification waiver form for items bought that do not meet recycled content requirements can found on this site. In addition, there is a pick-up schedule and a place to request recycling pick-ups. LaRC employees can also request recycling containers for their facility. Monthly metrics on the recycling program are also available.
- **Air Pollution Management Program**
This site gives information on LaRC's Air pollution management program. Information on LaRC's air permit and answers to frequently asked questions about air pollution control measures at the Center are posted here.
- **Waste Management Program**
This link provides information on the hazardous waste definition, how to handle the waste, and proper disposal procedures. The site also has links to inspection and spill plan forms for use by Center personnel.
- **Environmental Program Metrics**
Monthly progress of activities and programs of the EMO can be found at this link. An archive of metrics from previous months is also available.

Resource Material

This section contains current policies, helpful forms, and environmental tips. There are currently links to the following materials.

- **Environmental Insight Newsletter**
This is the monthly EMO newsletter. It provides information on environmental issues that affect the employees at NASA LaRC. There are four sections to the newsletter: a main article on environmental issues, a section on LaRC environmental activities, a general environmental message, and the current recycling metrics. In addition, readers are allowed to send comments to the newsletter's editor.
- **Environmental Alerts**
This is an archive of Environmental Alerts that have been sent out to the Center. Environmental Alerts are memos sent to all Center employees and contractors that outline changes and additions to environmental policies at the Center and NASA.
- **Environmental Coordinators Reference Center**
This site is designed to be a central reference center for Facility Environmental Coordinators (FECs) and contains regulatory information pertaining to environmental issues, links to on-line services, access to forms, and helpful tips for the FEC.
- **Environmental Program Manual**
This page provides a link to the Environmental Program Manual located on the Langley Directives Management System website. The Environmental Program Manual specifies the Center's environmental policy by program area.

Services and Databases

This is a listing of links to the on-line services and references provided by the EMO. These services include LaRC's chemical tracking system, material exchange program, environmental training program, the Environmental Coordinator's reference section and database, and the affirmative procurement waiver form.

- **Chemical Material Tracking System or CMTS On-Line**
Center employees and contractors use the CMTS to maintain their chemical inventories. The Reuse Facility inventory and hazardous purchase approval form are integrated into the CMTS.
- **Electronic Form 44**
The Hazardous Materials Purchase Approval form is required when Center personnel need to purchase a hazardous material. The information from the form is used as one of the main data sources for the CMTS. These pages also give access to the status, print, and approval sections of the form.
- **Reuse Facility**
The Reuse Facility provides reuse of hazardous materials in an environmentally safe manner. It is used to centralize responsibility for the acquisition, storage, and distribution of hazardous materials for reuse. Center staff can search, view, and request a list of currently available items in the Reuse Facility through these pages.

- MSDS Library
This site contains a collection of Material Safety Data Sheets (MSDS) that can be searched by product name, manufacturer, or LaRC assigned MSDS number. Center employees can download electronic copies of the MSDSs to their computers from the on-line library.
- Environmental Coordinators Database
This site contains a listing of all current Facility Environmental Coordinators (FECs) on the Center. The FEC can be searched by name or building in the database. In addition, forms for FEC changes can also be accessed through this site.
- Environmental Training
This site contains a listing of all current training classes offered by the EMO as well as a form to request additional training.

The EMO Web site is constantly reviewed to ensure the content and presentation stays interesting and current. The basic layout of the site does not change which ensures that Center personnel can easily locate the information and services found on the site. Graphics on the site are often added and upgraded to improve the visual appearance and most metrics are updated monthly.

3.0 Recycling and Affirmative Procurement Program (RAPP)

3.1 Recycling Program

Executive Order (E.O.) 13101, “Greening the Government through Waste Prevention, Recycling, and Federal Acquisition”, requires Federal agencies to promote cost-effective waste reduction and recycling activities. NASA LaRC has developed a successful recycling program that consistently meets or exceeds program goals. See Section 4 for specific Recycling Program goals and the strategy for obtaining them.

LaRC’s Recycling Program has been successful because it:

- Meets or exceeds the recycling goals established by E.O. 13101.
- Maximizes collection and recycling of recyclables.
- Maximizes proceeds from selling the recyclables.
- Contributes to the preservation and conservation of the environment and its resources.

Solid waste and non-hazardous wastes are collected for disposal or sent off-site to be recycled. Materials collected by NASA LaRC for recycling include: aluminum (not aluminum cans), copper, ferrous metals, white and mixed paper, toner cartridges, cardboard, fluorescent tubes, batteries, oil and antifreeze. In addition, used oil is shipped off-site for energy recovery. The revenue generated from the sale of recyclable items is used to support the recycling and pollution prevention programs at LaRC. Appendix E provides a graphical representation and the breakdown of materials recycled at LaRC in FY 1997-2001. The metrics for LaRC’s recycling program are accessible through the Environmental Management Office (EMO) homepage (<http://osemant1.larc.gov/>).

3.2 Recycling Program Roles and Responsibilities

LaRC is committed to reducing solid and hazardous waste from Center activities. Doing so is a joint effort between many organizations as well as Center employees. Training and outreach are vital elements to having a successful recycling program. Training and outreach information can be found in section 2.6.

Recycling Program responsibilities specified in the Center’s environmental policy document, the Environmental Program Manual (LAPG 8800.1) follow. Standard collection procedures for the materials are detailed in LAPG 8800.1 and the Environmental Management Office website at <http://osemant1.larc.nasa.gov/rapp/>.

3.2.1 Environmental Management Office (EMO)

- Manage and oversee the Center’s recycling program.
- Prepare and mail monthly billing invoices to contractors.
- Act as the Center’s official representative with government and private parties on recycling related matters.
- Track the Center’s progress in meeting established recycling goals.
- Provide support, guidance, training, and assistance to Offices and Divisions in implementing the recycling program in order to meet or exceed established goals.

- Collect monthly metrics on the recycling program and make these available to Center personnel on the recycling webpage through the EMO homepage.
- Seek out new items to recycle and new commodity markets to maximize proceeds to LaRC from the sale of LaRC recyclable materials.

3.2.2 Office of Logistics Management (OLM)

- Provide day-to-day management of the collection of scrap metal, tires, precious metals and antifreeze.
- Provide technical assistance to Center personnel.
- Monitor recycling activities to ensure compliance with established recycling procedures.
- Provide copies of the scrap metal delivery order tickets to the EMO.
- Maximize the collection of these recyclable materials and maximize the proceeds to LaRC from the sale of the recyclable materials.

3.2.3 Facility Environmental Coordinators (FEC's)

- Ensure facility personnel follow established procedures.
- Post copies of the relevant recycling procedures and updates in a prominent location and/or near recyclable material collection areas.
- Monitor recycling collection areas and arrange for pickup, if necessary. Ensure collection containers are not contaminated with non-recyclable materials.
- Educate facility employees about the recycling program or contact the EMO at 48058 to arrange for specific training.
- Inform the EMO of additional items that could be recycled or suggest improvements for the Center's recycling program.

3.2.4 Center Employees and Contractors

- Participate in the LaRC recycling program.
- Read and understand the Center's recycling procedures distributed by the FEC or on the EMO recycling homepage <http://osemant1.larc.nasa.gov/rapp/>.
- Ensure collection containers are not contaminated with non-recyclable materials.
- Inform the FEC or the EMO of additional items that could be recycled or improvements for the Center's recycling program.
- Attend facility training on LaRC's recycling procedures.

3.3 Affirmative Procurement Program

Affirmative procurement is the purchase of materials or products with recycled or recovered content. Affirmative procurement guidelines require the government and its contractors to purchase items containing recycled or recovered materials to the maximum extent possible (see Appendix E) and utilize environmentally preferable products in order to stimulate the use of such products. Environmentally preferable products are products and services having a lesser or reduced effect on human health and the environment when compared to competing products or services serving the same purpose.

The *NASA Procedures and Guidelines (NPG) 8830.1, Affirmative Procurement Plan for Environmentally Preferable Products*, February 1, 1999 states NASA's policy for affirmative procurement. It requires each NASA field installation to develop and implement an affirmative procurement program in conformance with RCRA Section 6002. It is LaRC policy to acquire, in a cost-effective manner, items composed of the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, without adversely affecting performance requirements, quality, or safety by doing the following:

- Promote cost-effective waste reduction and recycling of reusable materials.
- Include the use of recovered materials in procurement specifications.
- Not require that items be manufactured of virgin materials in procurement specifications.

The LaRC Environmental Management Office (EMO) promotes the use of products with recycled content through their outreach and training programs (see Section 2.6). Affirmative procurement web pages give access to information on procurement pilot projects, regulations and guidance, a list of items that the Center must buy with recycled content, and access to the waiver form for justification on why items are not bought meeting recycled content requirements. Section 4 discusses LaRC's goals in affirmative procurement and Appendix E provides detailed quantitative data on EPA designated items purchased at LaRC.

3.4 Affirmative Procurement Program Roles and Responsibilities

Based on NASA policy and other regulations and requirements, NASA LaRC employees and contractors have the following responsibilities to fulfill pertaining to purchasing items with recycled or recovered material content. Affirmative Procurement responsibilities specified in the Center's environmental policy document, the Environmental Program Manual (LAPG 8800.1) follow.

3.4.1 Office of Procurement

- Understand the requirements of E.O. 13101 and the Federal Acquisition Regulation (FAR) Subpart 23.4. Understand the objectives of the NPG 8830.1 and know the EPA designated materials list and the Request for Waiver process.
- Ensure that the acquisition of products and services covered by applicable EPA guidelines are conducted in accordance with the requirements of the RCRA, E.O. 13101, FAR, and the NASA policy.
- Require statements of work or specifications to include: elimination of virgin material requirements, use of recovered materials, reuse of products, life cycle analysis, energy and water efficiency, recyclability; and the use of EPA designated items or other environmentally preferable

products. These factors should be considered in acquisition planning for all procurement and in the evaluation and award of contracts, as appropriate.

- Collect and compile the necessary data and information in a timely manner and provide to the Environmental Management Office to facilitate the process of procurement planning for the annual Affirmative Procurement Report and other required reports.
- Provide guidance and facilitate acquisition planning with respect to environmentally preferable goods and services, including those available through Federal sources of supply.
- Assist in any market research necessary to determine the availability of environmentally preferable goods and services.
- Ensure that solicitations and contracts contain the appropriate provisions and FAR clauses to implement Affirmative Procurement (FAR Part 23)
- Review and revise specifications, product descriptions, and standards and commercial item descriptions during the acquisition planning stage to enhance NASA's procurement of recycled and environmentally preferable products.
- Ensure that contracts, grants, and cooperative agreements include provisions that require documents to be printed double-sided on recycled paper meeting or exceeding the standards established in EPA guidelines.

3.4.2 Environmental Management Office (EMO)

- Understand the requirements of E.O. 13101 and the Federal Acquisition Regulation (FAR) Subpart 23.4. Understand the objectives of the NPG 8830.1 and know the EPA designated materials list and the Request for Waiver process.
- Develop and implement an affirmative procurement awareness program. NASA LaRC shall establish the affirmative procurement program for all designated EPA guideline items purchased. Newly designated items shall be incorporated into the affirmative procurement program within one year from the date EPA designated the new item.
- Advise procurement originators and contracting officers on acquisition strategies for environmentally preferable products and services including updates to the list of EPA's designated items.
- Review and approve Request for Waiver documentation and participate in Life-Cycle Cost and Life-Cycle Analysis (LCC and LCA) activities.
- Compile the Center's Annual Affirmative Procurement Progress Report.
- Provide support, guidance, and assistance to the Center in interpreting and implementing the EPA and applicable Agency guidelines for recovered materials.

3.4.3 Systems Engineering Competency

- Understand the requirements of E.O. 13101 and the Federal Acquisition Regulation (FAR) Subpart 23.4. Understand the objectives of the NPG 8830.1 and know the EPA designated materials list and the Request for Waiver process.
- Review specifications and amend the specifications, as appropriate, to encourage the use of recovered materials.
- Ensure that construction products are procured with recovered content levels as specified in Part C - Construction Products of the Recovered Materials Advisory Notice.
- Collect and compile the necessary data and information in a timely manner and provide to the EMO to facilitate the process of procurement planning for the annual Affirmative Procurement Report and other required reports.

3.4.4 Office of Logistics Management (OLM)

- Understand the requirements of E.O. 13101 and the Federal Acquisition Regulation (FAR) Subpart 23.4. Understand the objectives of the NPG 8830.1 and know the EPA designated materials list and the Request for Waiver process.
- Review specifications and amend the specifications, as appropriate, to encourage the use of recovered materials.
- Collect and compile the necessary data and information in a timely manner and provide to the EMO to facilitate the process of procurement planning for the annual Affirmative Procurement Report and other required reports.

3.4.5 Contracting Officers

- Understand the requirements of E.O. 13101 and the Federal Acquisition Regulation (FAR) Subpart 23.4. Understand the objectives of the NPG 8830.1 and know the EPA designated materials list and the Request for Waiver process.
- Provide guidance and facilitate acquisition planning with respect to Life Cycle Cost Analysis and environmentally preferable goods and services. The Life Cycle Cost Analysis should examine a product's environmental and economic effects throughout its lifetime, including raw materials extraction, transportation, manufacturing, use and disposal.
- Ensure solicitations and contracts contain the appropriate provisions and FAR (FAR Part 23, Subpart 23.4) clauses implementing affirmative procurement, including reporting requirements.
- Maintain information in the contract file on the contractor's response to FAR clause 52.223-8 "Estimation of Percentage of Recovered Materials for Designated Items".
- Collect and compile the necessary data and information in a timely manner and provide to the EMO for the annual Affirmative Procurement Report and other environmental reporting requirements.

- Modify existing contracts, in consultation with the NASA technical point of contact, which do not have Federal Acquisition Regulations (FAR) clauses implementing Affirmative Procurement. The implementing clauses in the FAR are located at FAR Part 23, Subpart 23.4 – Use of Recovered Materials.

3.4.6 Procurement Originators

- Understand the requirements of E.O. 13101 and the Federal Acquisition Regulation (FAR) Subpart 23.4. Understand the objectives of the NPG 8830.1 and know the EPA designated materials list and the Request for Waiver process.
- Consult early in the procurement process with appropriate parties (e.g., environmental specialists, contract specialists) to facilitate the process of procurement planning, which include LCC and LCA.
- Utilize statements of work or specifications which include elimination of virgin material requirements, reuse of products, use of recovered materials, energy and water efficiency, recyclability, and the use of designated items included in the CPG or other environmentally preferable products or services.
- Prepare Request for Waiver or justification for concurrence signature by the EMO if the guideline item is not available competitively, within a reasonable time frame, does not meet appropriate performance standards, or is only available at an unreasonable price.

4.0 Program Goals

NASA LaRC's Environmental Management Office (EMO) manages the Center's environmental program to ensure compliance with Federal, State, and local environmental regulations. In addition, each year the EMO sets goals for program support, remediation, hazardous waste and compliance, pollution prevention, recycling, and air emission reductions. The goals established reflect Greening the Government Executive Orders, NASA Headquarter program guidance, and EMO goals that further promote environmental stewardship.

Program goals and their progress are monitored throughout the year. The common strategies for achieving many of the Center's program goals include:

- Increase employee awareness through training and outreach. (see Section 2.6)
- Maximize the use of the Center's Chemical Material Tracking System (CMTS) and maintain accurate chemical inventories. (see Project No.1)
- Conduct multimedia environmental assessments of Center facilities to identify pollution prevention opportunities and keep abreast of Center operations. (see Section 2.5)
- Use the NASA Environmental Tracking System (NETS) to track and evaluate environmental program data.

Goals by environmental media area, their status and specific strategies for achieving them are given below. Appendix E provides the baseline and quantitative data for the environmental programs.

4.1 Hazardous Material Usage

NASA LaRC personnel use various hazardous materials to support the Center's mission. It is LaRC's policy to maintain chemical inventories within CMTS in order to obtain data for environmental reports and target reduction efforts. Executive Order goals that promote the reduction of hazardous materials use are below.

1. Reduce use of EO 13148 draft priority chemicals by 50% by Dec. 31, 2006. (Baseline is December 1, 2000)
2. Reduce TRI releases and off-site transfers of toxic chemicals by 10% annually or 40% by December 31, 2006. (Baseline is December 1, 2000)
3. Implement the pharmacy concept.

4.1.1 Status on Hazardous Material Reduction

CMTS allows facility personnel to track items as they are added, transferred and consumed. Inventories are updated quarterly which allows for a continuous evaluation of chemical usage (see Project No. 1). A CMTS report is being developed to track the proposed EO 13148 priority chemicals (see Appendix G). Known priority chemicals used at the Center are lead, silver and mercury. Below summarizes specific reduction efforts for silver and mercury at LaRC.

- Silver chloride use has been reduced significantly as digital photography increases on the Center and eliminates the silver chemistry development process.
- Over 105 mercury thermometers were turned in for replacement in FY01. A conservative estimate of 315 grams of mercury (most laboratory thermometers contain about 3 grams of liquid mercury), or approximately 0.69 pounds of hazardous waste was disposed.

NASA LaRC has only had to file one Form R over the past four years. In CY 2000, the Center shipped 53,000 pounds of lead off site for recycling. The large amount of lead was due to a shutdown of a facility research project. Due to more stringent regulations and lower TRI chemical reporting thresholds for reporting established in 2001, chemical use will be monitored closely. Since products and chemicals that contain mercury and lead will continue to be substituted with alternatives, there may be a future increase in off-site transfers.

LaRC implements a Reuse Facility to provide a means to reuse hazardous materials in an environmentally safe manner. Materials not being used, but in a condition allowing for reuse, are donated to the Reuse Facility for temporary storage and reissue, free of charge, to Center personnel that can use the material (see Project No. 61). The following table represents dollars saved from avoided procurement and disposal of chemicals.

**Table 4-1
Reuse Facility Cost Savings**

Fiscal Year	Cost Savings
FY98	\$1,938
FY99	\$3,567
FY00	\$1,321
FY01	\$9,275

4.1.2 Strategy for Hazardous Material Reduction

In addition to the common strategies used to achieve environmental goals, several specific strategies used to achieve hazardous material reduction are detailed below.

- Monitor the use of lower threshold EPCRA chemicals and target pollution prevention opportunities.
- Substitute alternatives for hazardous chemicals such as methylene chloride, toluene, and MEK.
- Continue evaluating and replacing thermometers and other mercury-containing devices on the Center.
- Continue to increase the use of digital photography to reduce silver photo processing chemicals.
- Consider replacement of lead/tin welding rods.

4.2 Hazardous Waste Management and Minimization

NASA LaRC is a large quantity generator of hazardous waste (HW) under the Resource Conservation and Recovery Act (RCRA). Each year, the Center generates thousands of pounds of hazardous waste from research and maintenance operations. Executive Order and EMO goals that promote hazardous waste minimization follow.

1. Reduce TRI off-site transfers of toxic chemicals for treatment and disposal by 10 percent annually, or by 40 percent overall by December 31, 2006. (Baseline is FY 2001)
2. Reduce generation of hazardous waste by 50 percent by December 31, 2006. (Baseline is FY 2001)
3. LaRC's Environmental Office has set an internal goal to reduce hazardous waste generation by 10 percent annually, or by 50 percent overall by December 31, 2006. (Baseline is FY 2001)

4.2.1 Status on Hazardous Waste Management and Minimization

The Center generated 53,071 pounds of hazardous waste in FY 2001. This includes remediation and one-time wastes. As this number serves as the baseline for future minimization efforts, the goal for FY 2002 waste generation is not more than 47,764 pounds. For the specific waste types that are included in the baseline, as well as waste generation data from previous years, refer to Appendix E.

4.2.2 Strategy for Hazardous Waste Management and Minimization

Over the past decade, NASA LaRC has consistently reduced the total amount of hazardous waste it generates annually (see Appendix E). Several strategies used to achieve waste reduction are detailed below.

- Ensure personnel who handle or oversee the handling of hazardous waste attend annual Waste Management Training. The training includes waste minimization information and personnel are given resources to properly manage and minimize waste at the Center.
- Maximize the use of the Center's Chemical Material Tracking System (CMTS). The system should be used to maintain a limited chemical inventory in order to avoid generating hazardous waste due to excess ordering or past shelf life issues. (see Project 61 – Reuse Facility)
- Identify two major hazardous waste streams generated at the Center and target these for reduction at the source of generation.
- Identify hazardous waste generation trends and target high volume waste streams for reduction.
- Reward and motivate LaRC personnel that develop waste minimization techniques. (see Section 4.9)

4.3 Alternative Fuel Vehicles

LaRC fleet vehicles are purchased through the Office of Logistics Management (OLM) for use on the Center and for off-Center business travel. Vehicle Maintenance keeps track of mileage and fuel consumption. Executive Order goals that promote the reduction of petroleum fuel consumption follow.

1. 75% of vehicles purchased must be alternatively fueled.
2. Reduce annual petroleum fuel consumption for fleet vehicles by at least 20% by end of FY05. (Baseline is FY99)
3. Implement outreach programs to reduce petroleum fuel usage.

4.3.1 Status on Petroleum Fuel Reduction

No fleet vehicles were purchased in FY01. However in FY02, the Center plans to purchase 8-10 new vehicles of which 75% will be alternatively fueled.

A contract for biodiesel fuel is expected to be implemented in FY02. A B20 biodiesel Blend (20% biodiesel: 80% petroleum diesel) will be used as a direct replacement for 100% petroleum diesel in diesel-fueled mobile sources. Use of biodiesel will contribute to achieving a reduction in petroleum fuel consumption.

Table 4-2
Alternative Fueled Vehicle Acquisitions

	# Fleet Vehicles Purchased	% of Alternative Fueled Vehicles	Fleet Vehicle Fuel Consumption		% Fuel Consumption Reduction
			Gasoline (gal.)	Diesel (gal.)	
FY99	15	67	Not Available	Not Available	NA
FY00	8	100	36,883	3,521	NA
FY01	0	0	36,136	2,513	4.3 %
FY02 (Est.)	8 – 10	75	NA	NA	NA

4.3.2 Strategy for Petroleum Fuel Reduction

In addition to the common strategies used to achieve environmental goals, several specific strategies used to reduce petroleum fuel consumption are detailed below.

- The Office of Logistics Management will continue to purchase alternatively fueled vehicles, which will reduce petroleum fuel use. In FY02, the Center plans to purchase 8 – 10 new vehicles of which 75% will be alternatively fueled.
- Secure biodiesel fuel contract and utilize fuel in diesel vehicles on the Center when it becomes available.

4.4 Solid Waste Generation and Diversion

Solid waste management and recycling are integral parts to achieving LaRC's environmental goals. Executive Order and EMO goals that promote solid waste generation and diversion follow.

1. Achieve solid waste diversion rate of 25% by 2005 and 35% by 2010. (Baseline is FY97)
2. For FY02, LaRC's Environmental Office has set an internal goal to increase total recycling by 5%. (Baseline is FY 01)
3. For FY02, LaRC's Environmental Office has set an internal goal to generate \$30,000 in recycling revenues.

4.4.1 Status on Solid Waste Generation and Diversion

Solid waste is any material discarded, abandoned, or considered waste. The following table summarizes the Centers solid waste generation and recycling efforts from FY97 through FY01.

Table 4-3
Solid Waste Generation, Diversion Percent and Recycling Revenue

	Solid Waste (lbs)	Recycled Materials (lbs)	% Diverted	Recycling Revenue
FY97	1,906,000	854,464	31%	\$52,879
FY98	3,390,000	1,439,681	30%	\$30,926
FY99	8,600,400	622,034	7%	\$18,452
FY00	8,280,400	815,670	9%	\$35,166
FY01	7,875,610	724,810	9%	\$21,722

Several buildings have been going through rehabilitation and modification, creating a significant amount of construction and demolition waste. Construction and demolition debris were not included in the total solid waste generated in FY97 and FY98, therefore the diversion rate is higher. Currently, NASA Headquarters has not provided guidance to Centers as to what is included in the solid waste number. Appendix E provides detailed quantitative data on the Centers Solid Waste and Recycling Program.

4.4.2 Strategy for Solid Waste Generation and Diversion

The current solid waste and recycling program is very successful overall. Achieving the above goals will only strengthen the programs. Several specific strategies to achieve waste reduction are detailed below.

- Provide recycling training to increase collection and decrease contamination. It is important for all employees to understand the environmental and economical benefits of an effective recycling program at the Center.
- Keep abreast of the different manufacturing technologies, recycling markets and equipment. Identify and evaluate new items for recycling and resale.
- Work with LaRC Procurement Office to incorporate the appropriate language into rehabilitation and modification contracts. These contracts should include contract language that requires the contractor to minimize the generation of landfill waste by maximizing the recycling of construction and demolition waste. This will require contractors to consider the entire life cycle of a building in the design phase or when modifying buildings. Buildings should contain materials that are sustainable, which are easily recycled and conserve natural resources.

4.5 Affirmative Procurement

Affirmative Procurement is an effort to promote the use of materials recovered from solid waste. Buying recycled-content products ensures that materials collected in recycling programs will be used again in the manufacture of new products. Executive Order goals that promote the purchase of these products follow.

1. Purchase paper products using benign pressure sensitive adhesives.
2. Purchase biobased products.
3. Procure items in accordance with RCRA section 6002.

4.5.1 Status on Affirmative Procurement

The Environmental Management Office (EMO) promotes the use of products with recycled content through their outreach and training programs (see Section 2.6). Affirmative procurement web pages give access to information on procurement pilot projects, regulations and guidance, a list of items that the Center must buy with recycled content, and access to the waiver form for justification on why items are not bought meeting recycled content requirements. Appendix E provides detailed quantitative data on EPA designated items purchased at LaRC. Below represents the total purchases of EPA designated items at LaRC and the percentage of purchases that contained recycle content.

Table 4-4
Percentage of Recycled Content Purchases of EPA Designated Items

	Total Purchased	Percentage with Recycled Content
FY 1997	\$1,532,866	45%
FY 1998	\$54,272	77%
FY 1999	\$295,168	82%
FY 2000	\$272,652	88%

The goal is to purchase all EPA designated products with recycled content, or have an approved waiver that justifies why it does not contain recycled content. There was only one waiver approved in FY00. Although it shows an increase in affirmative procurement purchases, the Center's tracking mechanism is not integrated into the purchasing system and therefore may not be accurate. Personnel on the Center are required to track purchases of EPA designated items and submit the results to EMO annually. EMO compiles the information from Center personnel and enters the information into the NASA Environmental Tracking System (NETS).

LaRC has not promoted the purchase of paper products using benign pressure sensitive adhesives or biobased products and therefore has no records indicating their purchase. Paper products using benign pressure sensitive adhesives have limited information and market availability to date. However, a contract for biodiesel fuel is being established for FY02. Biodiesel will be used in diesel fueled mobile sources.

4.5.2 Strategy for Affirmative Procurement

“Closing the loop” and purchasing products with recycled content will strengthen the environment, markets, and environmental programs. Several specific strategies to achieve affirmative procurement goals are detailed below.

- Work closely with the LaRC Procurement Office to maximize the use of EPA designated products and strengthen the tracking mechanism.
- Promote the purchase of paper products using benign pressure sensitive adhesives through training and outreach. Track and monitor purchases of these items.
- Promote the purchase of biobased products through training and outreach. Track and monitor purchases of these items. Assist in securing the biodiesel fuel contract.

4.6 Air Quality

NASA LaRC is a generator of air pollutants defined and regulated under the Clean Air Act (CAA). A State Operating Permit issued by the Virginia Department of Environmental Quality (DEQ) contains enforceable air emission limits that apply to operations at the Center. Ozone depleting substances (ODS's) are also used at the Center. The production and use of ODS's are regulated by the Montreal Protocol and the CAA Amendments of 1990. Executive Order and EMO goals that pertain to air emissions follow:

1. LaRC's Environmental Office has set an internal goal to limit annual criteria pollutant emissions to less than 45,000 pounds/yr.
2. E.O. 13148 calls for each agency to develop a plan to phase out the procurement of Class I ozone-depleting substances for all nonexcepted uses by December 31, 2010.
3. Evaluate the present and future uses of ODSs, including making assessments of existing and future needs for such materials, and evaluate use of, and plans for recycling, refrigerants, and halons. Maximize the use of safe alternatives to ODSs as approved by the EPA's Significant New Alternatives Policy (SNAP) program.

4.6.1 Status on Air Quality

In FY01, emissions of criteria pollutants (NO_x, SO₂, CO, PM10) and VOC totaled 45,990 pounds. Exceedence of the FY2001 goal was due primarily to the use of #2 fuel oil in the Steam Plant boilers in the winter of 2000. Due to high natural gas costs and curtailment of natural gas supply in the winter, the Steam Plant boilers switched to #2 fuel oil burning which resulted in increased SO₂ emissions from the Center. Unless there is a dramatic change in research activities at NASA LaRC in FY2002, emissions of criteria pollutants are expected to be about the same as in FY01.

Maria Bayon, at NASA Headquarters is assigned to lead the agency's efforts to comply with the ODS phase-out plan portion of E.O. 13148. We will be working with NASA Headquarters and the NASA Clean Air Act Workgroup to assist with developing a plan.

4.6.2 Strategy for Air Quality

To meet the above goals, NASA LaRC will pursue the following strategies to comply with applicable regulations and to minimize air emissions:

- Evaluate tracking and ODS usage data to identify opportunities for safe alternatives. Johnson Controls performs refrigerant management, therefore, EMO should work closely with them to evaluate the program and maximize the use of safe alternatives to ODS's.
- Ensure compliance with 40CFR82 Subpart F. Refrigerant management is regulated under 40CFR82 Subpart F (Recycling and Emissions Reduction). Work closely with Johnson Controls to ensure that we are in compliance with the applicable regulations.
- Seek alternatives to CFC-113 Cleaning of Oxygen Systems. CFC-113 is a regulated, Class I controlled substance. Project No. 73 involves seeking an alternative to CFC-113 cleaning of oxygen system components.

4.7 Energy Conservation

The Center uses large amounts of energy to operate its facilities and conduct research, especially for its wind tunnels. In the past, energy conservation at the Center has not been a priority. The low cost of electricity at the Center makes it harder for energy reduction projects to be cost effective. The nature and extent of LaRC's research requires large amounts of energy, many of which are exempt from Federal reduction goals. However, there are still goals that the Center must strive to achieve. Executive Order goals that promote energy conservation follow.

1. Reduce energy consumption for non-mission variable facilities per BTU, per gross square foot by 30% by 2005 and 35% by 2010. (Baseline year is 1985)
2. Reduce energy consumption for energy-intensive facilities per BTU, per gross square foot by 20% by 2005 and 25% by 2010. (Baseline year is 1990)
3. Expand the use of renewable energy.
4. Apply principles of sustainable design as set forth by DoD and GSA.
5. Conduct annual energy audits for approximately 10% of Center's facilities.
6. Purchase ENERGY STAR® energy-using products. When these products are impractical or unavailable, select products that are in the upper 25% of energy efficiency as designated by FEMP.

4.7.1 Status of Energy Conservation

Facilities at the Center are placed under three energy categories: Mission Variable (which are excluded from energy conservation goals), Non-Mission Variable, and Energy Intensive. A brief explanation of these categories can be found in Appendix E under the Energy Program. LaRC's Non-Mission Variable energy consumption decreased slightly in FY01, while the Center's Energy Intensive Facility energy consumption increased significantly. The increase in energy consumption for energy intensive facilities is attributed to increases in research and seasonal conditions. Although energy consumption for energy

intensive facilities increased, the Center is on track to meet the 20% reduction goal by the end of 2005. The following table provides energy consumption data for the Center.

Table 4-5
Energy Consumption at NASA LaRC (FY99 - FY01)

	Non-Mission Variable Facilities (Baseline FY85)	Energy Intensive Facilities (Baseline FY90)
Baseline Year	511,440 Btu/GSF*	602,890 Btu/GSF
FY99	123,840 Btu/ GSF	565,272 Btu/ GSF
FY00	103,988 Btu/ GSF	509,724 Btu/ GSF
FY01	103,914 Btu/ GSF	578,143 Btu/ GSF
% Reduction (from baseline)	15.4%	4.1%

*Gross Square Feet

Energy conservation projects completed in FY01 include the replacement of air conditioning systems, air handling units, air compressors, chillers, HVAC systems and the replacement of Hi-bay windows in Building 1265. Detailed information on these projects can be obtained through the Center's Energy Manager.

Renewable energy relates to alternative, more energy efficient sources that conserve our natural resources and reduces the government's dependence on foreign resources, such as petroleum. The Center's use of renewable energy is dictated by availability from local energy providers. In FY01, approximately two percent of Virginia Power's supplied energy to the State was renewable¹. Although it is difficult to quantify how much of this energy was supplied to the Center, NASA LaRC meets the goal of the Order through its purchase. Biodiesel will be used in FY02 as an alternate diesel fuel source for mobile sources on the Center, but could eventually be a source of renewable energy for stationary sources.

Sustainable design is a new concept in environmental engineering overall, and especially at the Center. The Center's Facility Engineering Branch is responsible for identifying and integrating energy efficiency into new Center's facility design. Design personnel have attended sustainable design workshops and the Center will implement the concept in the future.

Energy audits will be helpful in identifying energy conservation opportunities. Preliminary work for an energy audit began in FY01 and will be conducted in FY02. In addition, LaRC purchases all microcomputers, monitors, and printers that meet the ENERGY STAR[®] requirements of Executive Order 13123.

4.7.2 Strategy for Energy Conservation

In addition to the common strategies used to achieve environmental goals, several specific strategies used to reduce energy consumption are detailed below.

- Energy audits should be conducted to determine the quantity of energy used and to target energy reduction opportunities.
- Implement sustainable design principles in future renovation/design projects at the Center.

¹ Virginia Power's certificate. Copy can be obtained from the Center's Water and Energy Manager.

- Secure biodiesel contract and expand use of other renewable energy sources at the Center.
- Continue purchasing ENERGY STAR® products to comply with Executive Order 13123.

4.8 Water Conservation

NASA LaRC uses large quantities of water for daily operations, research activities and for energy. The largest users of potable water at the Center are cooling towers, single pass cooling systems, steam ejectors, and the Refuse Fired Steam Generating Plant. Executive Order goals that promote water conservation are as follows:

1. Reduce water consumption and associated energy used.
2. Conduct annual water audits for approximately 10% of the Center's facilities.

4.8.1 Status of Water Conservation

Water consumption has been reduced due to improved facility maintenance and increased awareness. The Center saved 17.9 million gallons of water in FY01 compared to FY00 (see Appendix E). The decrease is attributed to continuing water conservation efforts completed during FY99, including the detection and repair of several leaks, and the dissemination of general water conservation information to the facilities.

Annual water audits have not been conducted to date, but will begin in FY02. The support contractor, Johnson Controls will be responsible for conducting the audits to identify facility water usage and water reduction opportunities.

4.8.2 Strategy for Water Conservation

In addition to the common strategies used to achieve environmental goals, specific strategies used to reduce water consumption are detailed below.

- Conduct water audits and identify water reduction opportunities.
- Implement water efficient landscape practices. (see Section 4.10)

4.9 Awards Program

An important part of the success of pollution prevention is that those who work at the Center practice it. Through training and outreach the EMO strives to get LaRC employees involved. Many of them may be able to identify opportunities that the EMO may overlook since they work at their facilities and are more aware of processes. As an incentive to Center employees helping prevent pollution, the EMO would like to implement an awards program that will reward outstanding environmental efforts at the Center. Section 103 of Executive Order 13148 mandates the development of an internal agency-wide awards program to reward and highlight innovative programs and individuals showing outstanding environmental leadership.

4.9.1 Status of Awards Program

The EMO has submitted nomination packages for the White House Closing the Circle Award and the Hampton Roads Sanitation District's (HRSD) Pollution Prevention Excellence Award. In FY01, the Center won the 2001 HRSD Pollution Prevention Award for the water conservation project implemented at the Steam Plant. In addition, the project was highlighted in the *News Researcher*.

In FY01, the EMO worked on development of an internal environmental awards program. Justification for the program was submitted for approval to the NASA LaRC Directors Office. The proposed LaRC environmental awards program has not been approved. NASA Headquarters is working on development of an internal, agency-wide awards program to reward and highlight innovative programs and individuals showing outstanding environmental leadership. NASA HQ is working with Human Resources to develop and refine the details and specifics of this program.

4.9.2 Strategy for Awards Program

In addition to the common strategies used to achieve environmental goals, several specific strategies to recognize environmental efforts are detailed below.

- Although there is no established environmental awards program at LaRC, provide support, as needed, to NASA HQ in their efforts to develop an agency-wide awards program.
- Continue to support and solicit nominations for external awards programs such as the Federal Environmental Quality Award, the White House Closing the Circle Award and the HRSD Pollution Prevention Award.
- Showcase employee efforts in the monthly environmental newsletter or the Center's *News Researcher*.

4.10 Beneficial Landscaping

Beneficial landscaping is the use of landscaping techniques that are environmentally friendly, helping to retain the natural landscape and promoting plant health and longevity. Beneficial landscaping, also known as sustainable landscaping, encourages a self-perpetuating landscape that reduces the use of fertilizers, pesticides, labor and money. Beneficial landscaping is guided by five basic principles: 1) Using regionally native plants, 2) Designing, using or promoting construction practices that minimize adverse effects on the natural habitat, 3) Seeking to prevent pollution, 4) Implementing water and energy efficient practices, and 5) Creating outdoor demonstration projects. Executive Order goals that promote beneficial landscaping follow.

1. Identify and implement environmentally sound landscaping practices.
2. Develop model demonstration programs.
3. Purchase environmentally preferable and recycled content products that contribute to beneficial landscaping practices.
4. Provide information on environmentally and economically beneficial landscaping.

4.10.1 Status of Beneficial Landscaping

The Center practices one of the basic principles of beneficial landscaping by using limited fertilizers, pesticides and herbicides to maintain Center grounds. The EMO plans to implement a beneficial landscaping project in the Spring of FY02. A web survey allowed Center employees to comment on their favorite project and locations. LaRC hopes that the project will become a model for other NASA Centers and will serve as a blueprint for future beneficial landscaping projects at LaRC.

In FY01, the Langley Child Development Center (LCDC) initiated the use of beneficial landscaping. The children planted a vegetable garden that conserves water and uses no chemical pesticides or fertilizers, as well as implemented a small butterfly garden.

4.10.2 Strategy for Beneficial Landscaping

In addition to the common strategies used to achieve environmental goals, several specific strategies used to promote beneficial landscaping are detailed below.

- Implement the most feasible beneficial landscaping project selected by Center employees.
- Update Web page when more information becomes available. Increase awareness of beneficial landscaping through the Web page by running an article in the newsletter.
- Use environmentally preferable and recycled landscaping products for implementing beneficial landscaping projects, where practical.

Appendix A
Pollution Prevention Accomplishments

Appendix A is a compilation of Pollution Prevention Accomplishment projects at NASA Langley Research Center. The implementation of these projects has been completed, but their progress continues to be monitored. A table indicating each project number, name, and summary of information is given in Table A-2. As new projects are added and existing projects are updated or completed, the Pollution Prevention Plan becomes more voluminous. To minimize the size of the Pollution Prevention Plan document, some project descriptions refer the reader to the Pollution Prevention Plan in the year it was implemented in order to find detailed background information on the project. The following table provides project ranking data based on criteria described in Section 2.3 of the Plan.

Table A-1
Pollution Prevention Accomplishment Rankings

Proj #	Title	C- N/C	Total Score	C- N/C	Liab	MI	Cost		Env Ben	EI	LE	Infra
							Inv	Pbk				
61	Reuse Facility	C	470	100	40	40	10	15	10	75	75	100
112	P2 Facility Assessments	C	470	85	45	25	15	15	20	85	85	95
67	Oil Analysis Program	C	447	95	45	25	12	15	20	80	75	80
100	Propane Gas Cylinder recycling	N/C	433	40	45	25	15	20	25	98	95	70
89	Alternative Fueled Vehicles	C	428	100	30	20	5	8	20	75	75	95
11	Oil/Water Separator Study	C	424	95	47	30	10	15	17	85	75	50
106	Water Conservation	C	417	84	30	20	13	13	20	74	76	87
102	Bulk Oil Purchase at Vehicle Maintenance	N/C	415	40	20	25	10	20	20	100	100	80
95	Aerosol Can Recycling	N/C	414	50	18	25	11	13	27	80	100	80
77	Scrap Metal Recycling Program	N/C	400	50	15	25	15	15	25	75	80	100
51	Aerosol Usage and Alternatives Study	C	398	90	40	18	10	10	20	80	80	50
98	Drum Acquisition and Recycling Program	N/C	392	40	15	25	10	5	27	90	90	90
14	Recycling Containers	N/C	392	40	10	30	17	17	22	88	85	83
105	Cardboard Reuse	N/C	390	42	17	25	10	15	27	82	85	87
110	Rancid Coolant Assessment	N/C	388	45	25	25	9	15	25	79	82	83
23	Recycling Incentive Program	N/C	363	50	12	21	19	19	16	70	85	71
109	Digital Photography Assessment	N/C	351	30	30	22	8	9	25	70	87	70
30	Contract Review	N/C	347	40	19	25	10	18	25	65	65	80
70	Composting of Landscaping Wastes	N/C	346	40	25	20	14	2	15	90	90	50
31	Parts Washer Assessment	C	340	76	43	20	0	9	17	55	70	50
52	Antifreeze Recycling Assessment	N/C	290	46	10	25	8	10	16	50	65	60
58	Cardboard Recycling Study	N/C	265	20	10	25	11	8	20	61	50	50
94	Reuse of Jet Fuel	C	175	40	20	20	15	15	15	30	20	0

Table A-2
Pollution Prevention Accomplishments

Project No.	Project Name	Information on P2 Accomplishments
11	Oil/Water Separator Study	Various routine operations at LaRC generate oily water waste. As an effort to help reduce waste disposal and associated costs, the EMO installed an oily water separator in Building 1181. Once the oily water is processed, the product water is tested for HRSD metals and oil and grease. If analytical results are below allowable permit limits, the product water gets discharged to HRSD after receiving approval from EMO. In FY01, 15,010 gallons of oily water were processed, resulting in a cost savings of \$10,957. Cost savings are calculated based on avoided disposal cost of oily water.
14	Recycling Containers	All paper-recycling containers have been distributed throughout the Center. Additional recycling containers are purchased on an as needed basis to support the Recycling Program. Recycling containers that are purchased have the required recycled content of material as designated by the U.S. Environmental Protection Agency (EPA).
23	Recycling Incentive Program	The revenue generated from the sale of recyclable items is used to support the recycling and pollution prevention programs. Examples of equipment purchased from the sale of recyclable materials in FY01 are aqueous parts washers, cardboard recycling bins, and paper binder cutters.
30	Contract Review	The Center's contract office continuously revises contract language to incorporate environmental regulation requirements. Contracts that potentially have environmental impact are routed to the EMO for review. In FY01, EMO reviewed 27 contracts and added 5 revisions to promote the use of EPA designated items with recycled content.
31	Parts Washer Assessment	Solvent parts washers are regulated under the Center's Air Permit (see Appendix E). An inventory of parts washers is maintained by EMO. In FY01, a parts washer was removed from Building 648 and an aqueous parts washer was purchased for Building 1225 and will be installed in FY02.
51	Aerosol Usage and Alternatives Study	Many spray paints used on the Center tend to be solvent-based and/or may contain CFC propellants. The solvents have been targeted for reduction and most aerosols containing CFCs have been disposed and/or replaced by non-CFC propellants. For information on specific projects, refer to Project. No. 32 and Project Nos. 80, 82 and 83. Proper disposal of the cans is also an issue. Proper collection and disposal procedures of empty, partially empty, or non-pressurized cans are discussed in Aerosol Can Recycling - Project No. 95. Additional information on this project can be found in the 1996 Plan.
52	Antifreeze Recycling Assessment	The majority of antifreeze is generated at Building 1199, Vehicle Maintenance. An antifreeze recovery unit was purchased for the facility and recycling began in 1996. In FY01, two 55-gallon drums of antifreeze (858 lbs.) were recycled. Additional information on this assessment can be found in the 1996 Plan.
58	Cardboard Recycling Study	Cardboard is generated throughout the Center. Currently, there are 19 facilities designated as large generators that are collected on a weekly basis. Small generators place their cardboard next to their paper recycling bins and are collected as needed. In FY01, 27.99 tons of cardboard were collected for recycling at the Center.

Table A-2 (cont.)
Pollution Prevention Accomplishments

Project No.	Project Name	Information on P2 Accomplishments
61	Reuse Facility	The Reuse Facility allows for the reuse of hazardous materials in an environmentally safe manner. The Reuse Facility centralizes acquisition, storage, and distribution of hazardous materials for reuse and has been operational since 1996. Center personnel are provided with information about the Reuse Facility through training and outreach. In FY01, the Reuse Facility saved the Center \$9,275. Cost savings are calculated by avoided disposal costs and procurement costs for chemicals.
67	Oil and Hydraulic Analysis Program	The Oil and Hydraulic Analysis Program is designed to reduce oil waste, conserve raw materials, and decrease labor associated with oil changes. The program consists of testing and analysis of critical lubricating systems using various technologies and commercially available software. The test results are used to determine whether the fluids should be filtered, changed, or left alone. The results are also used to trouble shoot problematic equipment and are a powerful diagnostic tool that allows for analysis of trends to establish testing schedules. The program has been contracted out and the contractor will provide EMO with a quarterly report that indicates the number of samples taken, the capacity of oil filtered and the capacity of oil changed.
70	Composting of Landscaping Waste	The Center has an active composting program. All shrubs, tree limbs and leaves are sent offsite to be composted by the City of Hampton. Grass clippings are left on the lawn for fertilization, which also supports beneficial landscaping practices.
77	Scrap Metal Recycling	Scrap metal is generated at numerous facilities throughout the Center. The metals are segregated at the facilities and placed in the appropriate bins by NASA employees. The scrap metal is collected from the facilities by a support contractor, and transported to the scrap yard. In FY01, the Center sold 368,519 pounds of mixed metal, 3,410 pounds of aluminum and 4,490 pounds of copper for a total of \$6,132.
89	Alternative Fueled Vehicles	No fleet vehicles were purchased in FY01. However in FY02, the Center plans to purchase 8-10 new vehicles, of which 75% will be alternatively fueled. Also, a contract for biodiesel fuel is expected to be implemented in FY02. A B20 biodiesel Blend (20% biodiesel: 80% petroleum diesel) will be used as a direct replacement for 100% petroleum diesel in diesel-fueled mobile sources. Use of biodiesel will contribute to achieving a reduction in petroleum fuel consumption (see Section 4.3).
94	Jet Fuel Reuse	A sample of fuel is taken from the aircraft-refueling vehicles and visually inspected for particles and water. Once removed, the fuel cannot be returned to the aircraft-refueling vehicle due to quality assurance concerns. Instead of disposing the jet fuel, hangar personnel began reusing the jet fuel in fueling trucks. In FY01, 805 gallons of jet fuel were reused producing a savings of \$2,093. Cost savings are calculated from avoided cost of new fuel and waste disposal.
95	Aerosol Can Recycling	Aerosol cans are collected in specific accumulation containers at generating facilities. When the accumulation containers are full, personnel have the option to fill out a NASA Form N663 or electronically request the accumulation container be picked up. The aerosol cans are transported to the Center's hazardous waste facility where the cans are punctured and drained. The punctured aerosol cans are stored in a 55-gallon drum that is crushed and recycled as scrap metal. In FY01, the Center saved approximately \$1,006 by recycling 620 aerosol cans. Cost savings are calculated by avoided disposal cost.
98	Drum Acquisition and Recycling	The Center started to purchase and store reconditioned drums in 1999. The storage area is graveled and fenced with two storage buildings. In FY01, 442 drums have been reissued throughout the Center, producing a savings of \$13,612. Savings are calculated based on avoided procurement costs of new drums. Additional information on this project can be found in the 1999 Plan.

Table A-2 (cont.)
Pollution Prevention Accomplishments

Project No.	Project Name	Information on P2 Accomplishments
100	Propane Gas Cylinder Recycling	Propane cylinders are commonly used at LaRC in operations including soldering and lab work. Waste cylinders must be handled as a hazardous waste since they are not "empty" until they have been devalved and the pressure has been relieved from the cylinders. The Propane Cylinder Recycling System was purchased on January 16, 1998. Currently, 56 cylinders have been recycled for a cost savings of \$10,745. Cost savings are calculated by avoided disposal costs of propane cylinders.
102	Bulk Oil Purchase at Vehicle Maintenance	Building 1199, Vehicle Maintenance has begun to purchase oil in bulk. The oil is purchased from a vendor that provides re-refined oil. Procurement of re-refined oil closes the recycling loop and complies with Executive Order 13101, which mandates Federal agencies to purchase certain products containing recovered material.
105	Cardboard Reuse	Cardboard is generated in large quantities and collected for recycling throughout the Center. At the Recycling Facility, standard issued boxes are separated and compiled into stacks of 25. The cardboard boxes are transported to the Center's shipping and receiving warehouse for reuse. When new standard cardboard boxes are requested, the shipping and receiving warehouse personnel issue the used boxes before giving new ones. In FY01, 255 cardboard boxes were reused producing a savings of \$274. Cost savings are calculated from avoided cost of new cardboard boxes.
106	Water Conservation	The Center's Water and Energy Manager has overall responsibility for the Water Program, including water conservation. In FY01, 17.9 million gallons of water were conserved, producing a cost savings of \$53,342. The Center plans on conducting water audits for at least 10% of its facilities in FY02. More information on Water Conservation can be found in Section 4.8.
109	Digital Photography	In the past two years, over 70% of wet chemistry photo processing has been eliminated as LaRC staff have converted to digital photography and discontinued using wet chemicals for development. In FY01, NASA HQs performed an assessment and recommended that the Center convert to digital processes within five years. Seven pieces of wet chemistry processing equipment have been removed and only four more remain.
110	Rancid Machining Fluid Assessment	LaRC's Advanced Machine Development Lab, Building 1225, has problems with their coolant going rancid. They began implementing a Coolant Management System to increase the effectiveness of the coolant by increasing the coolant life, preventing microbial spoilage, and saving on the cost of new materials and disposal of used coolant. In CY01, 8-55 gallon drums of non-hazardous coolant were disposed at a cost of \$680. This is an improvement from CY 1999 where 53-55 gallon drums of non-hazardous coolant were disposed at a cost of \$4,505.
112	P2 Facility Assessments	Multi-media facility assessments are conducted monthly to ensure compliance with local, state and Federal regulations in all environmental program areas. The assessments also assist the facilities and EMO in identifying possible pollution prevention opportunities. Forty-two facility assessments were conducted and fewer non-compliance issues were found in FY01 compared to FY00. More information on the audit process and assessments conducted in FY01 can be found in Section 2.5.

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Appendix B

Active Pollution Prevention Projects

Appendix B is a compilation of active projects at NASA Langley Research Center. Each project in this section includes an annual update. The following table provides project ranking data based on criteria described in Section 2.3.

Table B-1
Active Pollution Prevention Project Rankings

Proj #	Title	C- N/C	Total Score	C- N/C	Liab	MI	Cost		Env Ben	EI	LE	Infra
							Inv	Pbk				
32	Hazardous Materials Usage Analysis	C	477	95	50	35	10	14	18	90	90	75
1	Chemical Material Tracking System	C	456	100	48	40	8	15	15	70	60	100
13	Affirmative Procurement Plan	C	405	100	25	30	10	5	15	65	60	95
28	Employee Outreach and Training	N/C	397	50	30	25	10	5	12	90	85	90
55	Paint and Coatings Study	C	373	95	50	15	5	8	20	65	65	50
12	Recycling Plan Implementation	C	370	80	10	20	10	10	20	60	80	80
64	Air Pollution Prevention	C	310	100	50	20	8	12	20	50	50	0
73	Investigate Alts. to CFC Cleaning (Oxygen Systems)	C	302	90	30	10	2	5	20	45	50	50

PROJECT DESCRIPTION: Chemical Material Tracking System

Product: Chemical Material Tracking System (CMTS) Implementation

Criteria (Maximum Score Possible)		Considerations
Compliance (100)	100	<ul style="list-style-type: none"> Indirect environmental benefits will include toxic use reduction, waste minimization and improved control over hazardous materials. Facilities must maintain accurate inventories to capture hazardous material use and storage data for environmental regulatory reporting.
Mission Impact (40)	40	
Cost (30)	30	
Environmental Benefits (20)	15	
Liability (50)	40	
Implementation (100)	75	
Labor Intensity (100)	80	
Builds Environmental Infrastructure (100)	100	
Total (540)	480	

Background:

LaRC utilizes many chemical materials to perform various operations at the facility. In accordance with LAPG 8800.1, the Environmental Program Manual, each facility is responsible for ordering, storing, and tracking its own chemical materials. Facilities must submit a Form 44 to get approval from Safety and the Environmental Management Office (EMO) to purchase hazardous materials. Facilities must also use the Chemical Material Tracking System (CMTS) to track what materials they have in inventory or what materials have been used throughout the year. The implementation of CMTS has improved pollution prevention, waste minimization, and inventory management practices throughout the Center.

Issues:

The lack of information on chemical materials usage can create several areas of concern for pollution prevention and waste minimization. Specific issues include:

- Out-Of-Date Materials – Out-of-date materials has been an on-going problem at the Center. Often times when researchers retire or relocate, hazardous materials that they used are stored away. This has lead to an excess of materials, many of which are out-of-date, in the facilities. This creates storage problems for the facilities and creates disposal problems for the Center. It is difficult to determine the composition of old materials because sometimes the MSDS cannot be found, the vendor does not exist anymore, or the label is faded or missing.

Chemical Material Tracking System

- Lack of Information – Each facility is responsible for keeping an up-to-date inventory. In the past, facilities only had to report annual quantities of materials on-hand. Because there was no automated or manual tracking system in place at the Center to track material purchases or use of materials, obtaining data for environmental reporting requirements was a resource-intensive process. This lack of information made generating regulatory reports difficult, increased raw material purchases because facility personnel didn't know what they had on-hand, and increased the quantity of excess and out-of-date materials generated by the Center.
- Increased Costs for Raw Materials and Disposal – Facilities are responsible for purchase and management of their raw materials. Facility personnel tended to order materials in large batches or order excess material because of lengthy purchasing processes, therefore increasing raw material costs. In addition, this over purchasing increased the quantity of materials requiring disposal because much of the materials ordered would not be used before its expiration date.
- Poor Materials Management – LaRC has some chemical materials that have been on the Center for more than 20 years. Since these materials have never been tracked, there is no information on how long they have been in storage, and in some cases, what the material is. This can greatly increase the disposal cost for such items. For example, LaRC would have to spend approximately \$300 dollars to characterize a gas cylinder that cannot be identified, in addition to \$500 or more to dispose of the cylinder. Disposal costs vary based on the size of the cylinder, but proper materials management would save the Center money.
- Changes in Purchasing Procedures – Changes in purchasing procedures have created holes in the purchase approval process. A credit card program was implemented to facilitate faster delivery of materials to the Center. Implementation of this program created problems with the approval process because Center personnel could purchase hazardous materials without the approval of the Office of Safety and Mission Assurance, thereby decreasing the control of hazardous materials and the ability to track them.

Pollution Prevention Opportunities:

Roughly 75 percent of the identified benefits related to the above issues can be achieved by simply knowing the initiators of the chemical material life-cycle; that is, knowing which organizations and locations are using which materials and in what quantities. The remainder of the identified benefits can be realized by tracking which chemical materials are on hand at the facility, and knowing where they go if they change hands or locations. Implementing a well-designed chemical material tracking system will allow LaRC to track the entire chemical material life cycle.

- Needs Assessment – The Center conducted a Needs Assessment in 1994 to determine what type of tracking system was needed to manage inventories at a facility level, track use and transfers of materials and generate regulatory reports. The assessment determined:
 - the type of computer equipment and networking capability at the Center;
 - the electronic sources of inventory data available;
 - the procedures in place to facilitate tracking of materials at a facility.

Chemical Material Tracking System

This needs assessment provided pertinent information to design and implement a custom tracking system or to select commercial software for tracking purposes. A copy of the assessment can be obtained from the LaRC Environmental Management Office.

- Implement a Chemical Material Tracking System – Implementation of a Chemical Material Tracking System (CMTS) has provided many benefits to the Center. These benefits include improved inventory management and more up-to-date inventory information for regulatory reporting. The tracking system should maintain information pertaining to the chemical materials issued, their quantities, and the organizations and locations to which they are issued. This information is obtained when facility personnel file Hazardous Material Purchase Approval (Form 44) requests.

Project Status:

In the spring of 2000, efforts began for hardware and software updates in order to maintain system integrity due to the increase in usage and storage needs. The previous CMTS system used simple Web-based forms, a Web-to-database application development system, and Microsoft Access. The migrated system is supported by Microsoft SQL Server 7.0 and utilizes the prior system architecture. The migration and updates were completed in the fall of 2000. Additional information on improvements to the CMTS can be found in the 2000 P2 Plan or the CMTS documentation through the EMO.

Updates to inventories continue to be an on-going challenge with facility personnel. Some facilities keep their information current and others have not updated their inventories since the original CMTS kick-off date. EMO will continue to work with facility personnel to get inventories updated and give facility personnel training to help them understand the importance of the system and its functionality. EMO will ensure that inventory information provided through CMTS by facility personnel is accurate through facility multi-media audits (see Section 2.5.2).

Timeline:

- Throughout FY02
- Continue reminders for quarterly updates.
 - Continue training sessions for CMTS/Form 44s.
 - Identify system improvements.

PROJECT DESCRIPTION: Recycling Plan Implementation

Product: Recycling Program Implementation and Items Recycled

Criteria (Maximum Score Possible)		Considerations
Compliance (100)	80	<ul style="list-style-type: none"> E.O. 13101 requires federal agencies to recycle and to establish goals to increase the amount of material being recycled. Revenue generated from recycling goes into a Recycling Fund, which is used for future recycling and pollution prevention projects.
Mission Impact (40)	20	
Cost (30)	20	
Environmental Benefits (20)	20	
Liability (50)	10	
Implementation (100)	60	
Labor Intensity (100)	80	
Builds Environmental Infrastructure (100)	80	
Total (540)	370	

Background:

LaRC has an active recycling program that is mandated by Executive Order (E.O.) 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition," and Virginia State House Bill 1757. Executive Order 13101 requires federal agencies to establish a goal for solid waste prevention and a goal for recycling or solid waste diversion. The agency set a solid waste diversion rate of 25% by 2005 and a 35% diversion rate by 2010. House Bill 1757 mandates the City of Hampton to recycle at least 25 percent of the municipal solid waste produced within the city. LaRC, located within the City of Hampton, assists the City in meeting its recycling responsibility. The overall objective of LaRC's recycling program is to develop an efficient and cost effective recycling program that meets the following goals:

- Meet or exceed the recycling goals established by E.O. 13101.
- Maximize collection and recycling of recyclables.
- Maximize proceeds from selling the recyclables.
- Contribute to the preservation and conservation of the environment and its resources.

As illustrated in Exhibit 1, the Center is collecting a wide variety of items for recycling. The Environmental Management Office is working in conjunction with the Office of Logistics Management to operate the recycling program. The quantities of items recycled vary from year to year depending on workload and projects at the Center. Some of the recyclables such as scrap metal are influenced by refurbishing or construction projects at the Center. The Center collects recyclable items to sell to reclamation vendors. The proceeds from the sale of these items are used to fund recycling or pollution prevention projects. The recycling procedures and metrics are available for review by all Center personnel through the EMO's Web site (<http://osemant1.larc.nasa.gov/>).

Recycling Plan Implementation

FY 1996-2001 Recycling Statistics

Type of Material	FY96 (lbs.)	FY97 (lbs.)	FY98 (lbs.)	FY99 (lbs.)	FY00 (lbs.)	FY01 (lbs.)
Aluminum	37,326	14,960	0	9,050	195	3,410
Antifreeze	858	2,574	2,145	858	858	858
Batteries	5,108	1,718	4,536	9,565	3,230	4,438
Cardboard	53,760	57,440	56,280	50,860	49,940	55,980
Copper (incl. copper wire)	76,640	0	0	4,242	9,130	4,490
Ferrous Metals	423,110	472,380	896,150	397,800	382,980	368,519
Fluorescent Lighting Tubes	3,485	6,761	10,388	9,542	10,587	10,254
Mixed Paper	95,200	42,600	72,600	60,900	63,840	56,980
Toner Cartridges	1,860	1,190	1,789	1,444	1,557	1,441
Used Oil	91,940	87,210	98,598	35,440	64,660	31,080
White Paper	250,454	296,880	251,900	199,780	193,780	187,360
Total	1,039,741	983,713	1,394,386	779,481	780,757	724,810

The pollution prevention building houses a cardboard baler, paper baler, drum crusher, and oil/water separator. Paper and cardboard are baled in order to obtain the highest possible rebate for the sale of these recyclables. The proceeds collected from the sale of these recyclables are used to support the Recycling and Pollution Prevention programs.

Issues:

The current recycling program is very successful overall. However, there are several areas where the program can be strengthened. Specific issues include:

- Training – Center employees require training and information about the LaRC recycling program. Without training, employees are often uncertain as to which items can or cannot be recycled and the proper recycling procedures. Training is provided when requested by FEC's or facility personnel.
- Additional Recyclable Wastes – Several wastes at LaRC can be recycled to generate additional revenue. Research changes or Center operations may possibly generate wastes that can be recycled instead of disposed. For example, wood scrap, certain kinds of broken glass, and unused gases are valuable if recycled or reused.

Pollution Prevention Opportunities:

- Training and Awareness – Training employees on effective procedures for recycling different items will help increase collection and decrease contamination. It is important for all employees to understand the benefits of an effective recycling program at the Center.

Recycling Plan Implementation

- Identify Waste That Can be Recycled – With manufacturing technology changing, there will be an increase in different items that could be recycled. The Center's operations should be monitored in order to identify new opportunities.

Project Status:

As required by the Executive Order 13101, the agency set a solid waste diversion rate of 25% by 2005 and a 35% diversion rate by 2010. In FY01, the Center generated 7,875,610 lbs. of solid waste of which 724,810 lbs was recycled, which equates to nine percent of solid waste diverted. Section 4 contains specific Solid Waste and Recycling Program goals and the strategy for obtaining them, and Appendix E provides historical data for solid waste generated from FY 1997-2001. The NASA Environmental Tracking System (NETS) will be used to track progress of the solid waste diversion goal.

Overall, FY01 was a typical year for recycling on the Center with no significant increase or decrease in the generation amounts of any recyclable materials. Recycling Technicians will continue to monitor the overall progress of the recycling program and collect white and mixed paper, cardboard, and toner cartridges. With employee training, newsletter articles, and other outreach activities, we hope to lower the contamination levels and increase the amount of material collected for recycling. Appendix E provides a graphical representation and the breakdown of materials recycled at LaRC in FY 1997-2001.

Timeline:

Throughout FY02 – Continue to collect data and update recycling homepages.
– Strengthen LaRC's recycling program through employee outreach and training.
– Continue monitoring Center operations in order to identify new opportunities for recycling.

PROJECT DESCRIPTION: Affirmative Procurement Implementation

Product: A Strategic Plan for Affirmative Procurement Implementation

Criteria (Maximum Score Possible)		Considerations
Compliance (100)	100	<ul style="list-style-type: none"> Federal agencies are required by Section 6002 of the Resource Conservation and Recovery Act and Executive Order 13101, to buy certain products containing recovered materials. NASA Headquarters issued NPG 8830, “Affirmative Procurement Plan for Environmentally Preferable Products” on February 1, 1999 stating NASA’s policy for affirmative procurement.
Mission Impact (40)	30	
Cost (30)	15	
Environmental Benefits (20)	15	
Liability (50)	25	
Implementation (100)	65	
Labor Intensity (100)	60	
Builds Environmental Infrastructure (100)	95	
Total (540)	405	

Background:

Section 6002 of the Resource Conservation and Recovery Act and Executive Order 13101, “Greening the Government through Waste Prevention, Recycling, and Federal Acquisition,” requires federal agencies to buy certain products containing recovered materials. EPA has designated items with recovered content that federal agencies need to purchase, if applicable (see Appendix E).

NASA Headquarters issued NPG 8830.1, “Affirmative Procurement Plan for Environmentally Preferable Products” on February 1, 1999, stating NASA’s policy for affirmative procurement. It is NASA policy to acquire in a cost-effective manner, items composed of the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, without adversely affecting performance requirements, quality, or safety by doing the following:

1. Promote cost-effective waste reduction and recycling of reusable materials.
2. Include the use of recovered materials in procurement specifications.
3. Not require that items be manufactured of virgin materials in procurement specifications.

Issues:

Affirmative procurement requirements pertain to NASA LaRC and pose several issues. Specific issues include:

- Affirmative procurement is RCRA enforceable and can be included in the Center’s RCRA nonhazardous and hazardous waste audits.
- Waivers must be used to justify not purchasing designated items. Waivers are not being monitored and enforced for EPA designated items.

Affirmative Procurement Implementation

- Credit card purchases of designated items are difficult to track. Tracking mechanisms are not in place to capture purchases of EPA designated items.

Pollution Prevention Opportunities:

- Create a Tracking Mechanism - Integrate affirmative procurement requirements into the LaRC Procurement System in order to capture purchases of designated items. The system could also be designed to ensure waivers are approved prior to the purchase of designated products without recycled content.
- Create Pilot Programs for Affirmative Procurement – Promoting waste prevention by purchasing recovered items can slow the use of virgin material, as well as slow the rate at which the nation's landfills become filled and closed.

Pilot programs should be established at the Center to test the reliability of the procured items. Various designated products should be tested for durability and quality. Products exhibiting positive results will be recommended to the employees at LaRC.

- Training and Outreach – Employee outreach and training should be designed to raise environmental awareness and inform staff of their environmental responsibilities, empower and motivate staff to identify and implement affirmative procurement projects, and strengthen LaRC's environmental and affirmative procurement programs by building a core of informed and motivated employees.

Project Status:

The LaRC Environmental Management Office (EMO) promotes the use of products with recycled content through their outreach and training programs (see Section 2.6). Affirmative procurement Web pages give access to information on procurement pilot projects, regulations and guidance, a list of items that the Center must buy with recycled content, and access to the waiver form for justification on why items are not bought meeting recycled content requirements. LaRC's Affirmative Procurement Program and roles and responsibilities are discussed in Section 3. Section 4 discusses LaRC's goals in affirmative procurement and Appendix E provides detailed quantitative data on EPA designated items purchased at LaRC. Total purchases of EPA designated items at LaRC and the percentage of purchases that contained recycle content are provided below.

Percentage of Recycled Content Purchases of EPA Designated Items

	Total Purchased	Percentage with Recycled Content
FY 1997	\$1,532,866	45%
FY 1998	\$54,272	77%
FY 1999	\$295,168	82%
FY 2000	\$272,652	88%

The goal is to purchase all EPA designated products with recycled content, or have an approved waiver that justifies why it does not contain recycled content. There was only one waiver approved in FY01.

Affirmative Procurement Implementation

Although it shows an increase in affirmative procurement purchases, the Center's tracking mechanism is not integrated into the purchasing system and therefore may not be accurate. Personnel on the Center are required to track purchases of EPA designated items and submit the results to EMO annually. EMO compiles the information from Center personnel and enters the information into the NASA Environmental Tracking System (NETS).

The Office of Logistics Management (OLM) participates in the closed loop recycling program offered through GSA for re-refined oil. Re-refined oil is purchased through GSA at a discounted price and the used oil picked-up for recycling. In addition, a contract for biodiesel fuel is being established for FY02. Biodiesel will be used in diesel fueled mobile sources.

NASA LaRC procurement and contracts have implemented many affirmative procurement efforts in their programs. The Procurement Office has added the capability for users to identify items with recycled content in the credit card system and training programs. Language has been added to contracts to promote the use of designated products and to require contractors to track the use of designated items.

Timeline:

- Throughout FY02 – Continue to update the Website. Expand program to include other EPA designated items. Continue outreach and education for affirmative procurement products.
- Investigate Web-based training for affirmative procurement (see Project No. 111).
 - Design and implement a tracking mechanism for EPA designated items purchased.

PROJECT DESCRIPTION:**Training/Outreach Program****Product: Training and Outreach Program for the Environment**

Criteria (Maximum Score Possible)		Considerations
Compliance (100)	50	<ul style="list-style-type: none"> Developing the training will be inexpensive; payback will be high since properly trained employees will contribute to the program. Indirect environmental benefits may include fewer chemical discharges to the storm sewer and sanitary sewer and fewer environmental emissions. Training is a key part of establishing LaRC's environmental infrastructure. Liability will decrease because trained employees will properly handle and dispose of materials.
Mission Impact (40)	25	
Cost (30)	30	
Environmental Benefits (20)	20	
Liability (50)	18	
Implementation (100)	75	
Labor Intensity (100)	35	
Builds Environmental Infrastructure (100)	100	
Total (540)	353	

Background:

Employee outreach and training:

- Raises environmental awareness and informs staff of their environmental responsibilities in order to improve environmental compliance and stewardship,
- Empowers and motivates staff to identify and implement pollution prevention projects, and
- Strengthens LaRC's environmental and pollution prevention programs by building a core of informed and motivated employees.

Current environmental training is conducted by the Environmental Management Office. This training covers a broad range of environmental issues and topics and "sets forth policy, responsibilities, procedures, and environmental standards for implementation of the Environmental Program at the Center." There are four training subject areas at LaRC.

1. Facility Environmental Coordinator (FEC) Training
2. Senior Management Training
3. Environmental Awareness Training
4. Waste Management Training

Facility Environmental Coordinator (FEC) Training, Senior Management Training, and Waste Management Training are mandatory annual training courses. Environmental Awareness Training courses address a variety of topics, including: general environmental training, waste material management, pollution prevention and waste minimization, recycling, affirmative procurement, water and air regulatory compliance, chemical management, Chemical Materials Tracking System (CMTS) and Form 44 procedures.

Training/Outreach Program

In addition, the Environmental Management Office (EMO) has a variety of activities to support environmental outreach. The EMO Website allows Web users to access information on background, procedures, updates, and metrics of environmental program areas at the Center. On a monthly basis, the EMO electronically distributes the *Environmental Insight* newsletter and submits a feature environmental article to LaRC's bi-weekly *Researcher News* publication. LaRC also participates in local and national conferences and events, such as Earth Fest and the VA/DoD P2 Partnership, in order to share LaRC's environmental experiences.

Issues:

Training and outreach to staff are essential to an effective environmental program at LaRC and can overcome the following issues.

- Lack of Awareness – With employee turnover, a lack of environmental awareness among the staff is an issue. Many staff members do not understand proper waste management and disposal procedures. This is not to say that the staff does not have the desire to be environmentally aware. In fact, many staff members are anxious to learn more about their environmental responsibilities and how they can contribute to a more "green" way of doing business.
- Changing Environmental Policy – Environmental laws and regulations frequently change and Center personnel need to be aware of the changes to ensure compliance.

Pollution Prevention Opportunities:

Specific pollution prevention opportunities include:

- Environmental Program Manual – The manual, which outlines policies and procedures, is a useful tool and an excellent source of environmental information. It is available electronically through the Langley Management System (LMS) Website at <http://lms.larc.nasa.gov> and the EMO Website at http://osemant1.larc.nasa.gov/envcord/ref/env_ref.htm.
- Training and Outreach Programs – Revised policies, SOPs, and training materials are important, but to be effective, the information must be communicated to the staff.
- EMO Website – The Website (<http://osemant1.larc.nasa.gov/>) provides quick and easy access to information and services on environmental issues for Center personnel. The Website provides information on environmental programs, outreach and training materials, and who to contact for assistance in environmental program areas. The Website also contains links for various on-line services provided by the EMO. The services that can be accessed through the Website include the Facility Environmental Coordinator's Reference Page and Database, the Chemical Material Tracking System, the Reuse Facility, as well as various electronic forms and their approval status. See Section 2.6.2 for specific information on the EMO Website.
- Conferences/Outreach Events – LaRC participates in external environmental events and presents LaRC environmental activities at local and national conferences.

Training/Outreach Program

Project Status:

At least 24 environmental awareness training classes are conducted per year in order to reach the EMO internal goal. The classes are conducted based on requests from personnel or if training deficiencies are identified during multi-media audits. In addition, FEC training classes are conducted annually which includes an overview of all environmental program areas to ensure that FECs are aware of environmental issues and how they pertain to their facilities. Waste Management classes are also conducted several times a year. The following training classes were conducted during FY01.

Class	# of Classes Conducted	# of Attendees
CMTS/Form 44	25	107
Waste Management	2	47
Recycling	3	69
Affirmative Procurement	0	0
Pollution Prevention	0	0
Air/Water Awareness	0	0
General Environmental Training	2	27
FEC Training	<u>2</u>	<u>57</u>
Total	34	307

Outreach is also accomplished through documents and the Web. The Environmental Program Manual (EPM) outlines policies, procedures, and responsibilities for environmental issues. It is updated annually and is available electronically from the Langley Management System and EMO Websites. The EMO Website provides information on environmental programs, outreach and training materials, on-line services, and who to contact for assistance on environmental and compliance programs at NASA LaRC (see Section 2.6.2). An electronic mail announcing the *Environmental Insight* newsletter is sent monthly to all employees and contractors throughout the Center via the Website, *atlarc*. The EMO responds to Center personnel comments, questions, and suggestions newsletter issues.

Timeline:

- Monthly – Submit *Environmental Insight* and *Researcher News* articles.
- Throughout FY02 – Continue to update the EMO Website and provide environmental policy and/or information on pertinent issues.
 - Maximize training on the Center by tracking personnel environmental training and ensuring that mandatory classes are attended by required Center personnel.
 - Update Environmental Program Manual as needed.

PROJECT DESCRIPTION: Hazardous Materials Usage Analysis

Product: Hazardous Materials Usage Analysis

Criteria (Maximum Score Possible)		Considerations
Compliance (100)	95	<ul style="list-style-type: none"> • Compliance and reporting issues with respect to EPCRA, the Clean Air Act (CAA), and other Federal regulations emphasizes the importance of tracking usage of hazardous chemicals. • Eliminating or substituting hazardous materials with environmentally preferable purchases will decrease liability and waste disposal costs. • Fewer hazardous materials will benefit both LaRC personnel and the environment. • Analyzing hazardous material usage will help identify reduction or substitution opportunities which will reduce future environmental liability.
Mission Impact (40)	35	
Cost (30)	24	
Environmental Benefits (20)	18	
Liability (50)	50	
Implementation (100)	90	
Labor Intensity (100)	90	
Builds Environmental Infrastructure (100)	75	
Total (540)	477	

Background:

NASA LaRC uses various hazardous materials throughout the Center for research and development activities and for facility maintenance processes. Monitoring the use of these chemicals and finding alternatives to them are an important pollution prevention goal for NASA LaRC to ensure both worker health and safety and compliance with environmental regulations. Chemicals that have been concerns in the past have been solvent chemicals (i.e., methyl ethyl ketone, toluene, methylene chloride, varsol, etc.), and degreasers (i.e., glycol ethers, and ethylene glycol). However, with proposed priority chemicals and lower EPCRA reporting thresholds on persistent and bioaccumulative toxics (PBTs), the usage of these chemicals has become important to monitor.

Under section 503 of EO 13148, an interagency Workgroup drafted a list of 15 chemicals that may attribute to significant harm to human health or the environment. These chemicals were considered “priority” and have been targeted for reduction and substitution for identified applications (see Appendix G). Known priority chemicals used at the Center are lead, silver and mercury. In addition, EPA lowered its reporting thresholds for persistent and bioaccumulative toxics (PBT) chemicals in 2000, which includes lead, mercury, certain pesticides and polychlorinated biphenyls (PCBs).

The Center uses the Chemical Material Tracking System (CMTS) to monitor chemicals used on the Center (see Project No.1). In addition, employee interviews and pollution prevention multi-media assessments provide more conclusive data about hazardous materials use on the Center.

Issues:

Many of the hazardous materials used at the Center may adversely impact both the environment and human health. Specific issues concerning hazardous materials usage includes:

Hazardous Materials Usage Analysis

- Environmental Reporting – Some hazardous chemicals used at the Center are considered toxic and are regulated under the Emergency Planning and Community Right-to-Know Act (EPCRA). These chemicals must be reported on Tier II and Toxic Release Inventory (TRI) reports. PBT chemicals have lower reporting thresholds that must be monitored carefully for EPCRA. In addition, proposed priority chemicals need to be monitored to track reduction efforts to meet EO 13148 goals.
- Hazardous Wastes – Hazardous chemicals usually have to be disposed of as hazardous waste due to toxicity and/or flammability issues.
- Air Emissions – Chemicals such as toluene, benzene, and varsol, are designated as hazardous air pollutants (HAPs) and Volatile Organic Compounds (VOCs) under the Clean Air Act Amendments of 1990 (CAAA). The use of these chemicals must be carefully monitored to ensure compliance with the Center's air permit (see Section 4.6).
- Worker Health and Safety – Hazardous chemicals used on the Center can expose workers to health risks. Methylene chloride, for example, is a known carcinogen. Facilities must obtain a permit to use it and employees must wear protective equipment when working with the chemical.

Pollution Prevention Opportunities:

Material Substitution – Through substitution and elimination of hazardous materials, NASA can limit environmental reporting requirements, reduce hazardous waste disposal costs, reduce fugitive air emissions, and increase worker safety, all while protecting the environment. Replacements have been evaluated for many of the solvents and degreasers, and in many cases, have been replaced with less hazardous products. Additional opportunities to be investigated and/or implemented are detailed below.

- Replacement of welding rods – Lead/tin welding rods are a source of lead on the Center that could be replaced with lead-free rods.
- Replacement of mercury thermometers and switches – Replacing mercury thermometers with non-mercury thermometers, and replacing other mercury devices, such as switches, would reduce the majority of mercury used on the Center.
- Digital Photography – Converting to digital photography will reduce the use of silver in photo processing on the Center.

Project Status:

Chemicals such as methyl ethyl ketone (MEK), methylene chloride and toluene are contained in spray paints and are also used for surface cleaning. The substitution of these chemicals in spray paint is difficult because they are typically the prime component of the product, aiding in adhesion and durability. Facilities have been informed of lower volatile organic compound (VOC) paint that can be purchased through GSA. Facilities are encouraged to turn in the product as waste if they contain methylene chloride. For surface cleaning applications, facilities have been encouraged to use solvent free cleaners or less hazardous solvents such as acetone and alcohol on solvent wipes.

Hazardous Materials Usage Analysis

Methylene chloride is also found in gasket removers and paint strippers. In FY01, facilities tested methylene chloride-free *Napier* products and found them to be effective overall, but the process time for removing gaskets and paints was slower. The product has not yet been designated as a drop in replacement for these applications.

Alternatives to varsol, ethylene glycol and glycol ethers have also been investigated because they are regulated under the CAAA. Varsol-containing parts washers are being replaced with aqueous-based units where feasible (see Project No. 31). In FY01, facilities tested *Mirachem* 500 as an alternative to solvent-based and ethylene glycol and glycol ether-based cleaner/degreasers. Most facilities found the product to be satisfactory; some found that the product left streaks on the surface of metals that were cleaned. This and other products will continue to be tested as substitutes to ethylene glycol and glycol ether-based cleaners/degreasers.

NASA LaRC reported lead on the EPCRA TRI Form R for reporting year RY 2000. In CY 2000, the Center shipped 53,000 pounds of lead off site for recycling. The lead was the result of the shutdown of a facility research project. Due to more stringent regulations and lower TRI chemical reporting thresholds for RY 2001, the use of lead will be monitored closely.

Silver chloride use has been reduced significantly as facilities have converted to digital photography where feasible. Seven of the 13 silver chemistry photo development process units in the Photo Laboratory have been taken out of service. The Center intends to eliminate more units within the next 5 years.

Mercury thermometers were collected in May of 2001 in response to a DEQ mercury thermometer collection drive. Over 105 mercury thermometers were turned in and replaced in most cases, with non-mercury or digital thermometers. A conservative estimate of 315 grams of mercury (most laboratory thermometers contain about 3 grams of liquid mercury), or approximately 0.69 pounds of hazardous waste was disposed.

The Center has already eliminated the use of EPA listed PBT pesticide chemicals and PCBs on the Center. PCBs contained in transformer oil are exempt from EPCRA reporting. Since products and chemicals that contain mercury and lead will continue to be substituted with alternatives, there may be a future increase in off-site transfers. These chemicals will be monitored closely to ensure that EPCRA reporting thresholds are not exceeded.

Timeline:

- Throughout FY02 – Run CMTS reports to determine which chemicals are being used at the Center.
Use the data for environmental reporting.
- Conduct pollution prevention multi-media audits to identify reduction and substitution opportunities for hazardous materials.
- February 2002 – Submit Tier II Report
- July 2002 – Submit TRI Report

PROJECT DESCRIPTION:**Paint and Coatings Study****Product: Paint and Coatings Study**

Criteria (Maximum Score Possible)		Considerations
Compliance (100)	95	<ul style="list-style-type: none"> Section 6002 of the Resource Conservation and Recovery Act and Executive Order 13101 requires federal agencies to buy certain products containing recovered materials. NASA Headquarters issued NPG 8830, "Affirmative Procurement Plan for Environmentally Preferable Products" on February 1, 1999 stating NASA's policy for affirmative procurement. The U.S. General Services Administration's (GSA's) offers many reprocessed and consolidated paints for various applications. Eliminating or decreasing the use of oil-based paints will eliminate or decrease the cost to buy solvents. Disposal costs will also decrease, as non-hazardous waste is less expensive to dispose of than hazardous waste.
Mission Impact (40)	15	
Cost (30)	13	
Environmental Benefits (20)	20	
Liability (50)	50	
Implementation (100)	65	
Labor Intensity (100)	65	
Builds Environmental Infrastructure (100)	50	
Total (540)	373	

Background:

Oil-based paints contain and require the use of solvents for removal, which are harmful to human health and the environment. Aqueous-based paints are an alternative for painting most non-metal surfaces, however, aqueous-based paints are not suitable for coating metals for which corrosion control is an issue. Executive Order 13148 not only encourages the Center to reduce pollution (e.g., reduce the amount of oil-based paint and solvents), but also encourages the Center to purchase materials with recycled content to meet affirmative procurement requirements. This study focuses on researching paints with recycled content in addition to finding alternatives to oil-based paint.

Use of Reprocessed or Consolidated Latex Paint

Reprocessed paint is post consumer latex paint that has been sorted by various characteristics including light and dark colors, type (interior or exterior), and finish (gloss, flat). Reprocessed paint is available in a variety of colors and is suitable for both interior and exterior applications.

Consolidated paint is just that, leftover or extra paint that has been consolidated together. It does not go through any processing. Consolidated paint is typically used for exterior applications or as an undercoat where color and consistency are not primary concerns.

The EPA's Recovered Materials Advisory Notice (RMAN) recommends recycled-content levels for purchasing reprocessed and consolidated latex paint for specified uses as shown below:

Paint and Coatings Study

Product	Post Consumer Content %	Total Recovered Materials Content %
Reprocessed Latex Paint	20	20
• White, Off-White, Pastel • Grey, Brown, Other Dark Colors	50-99	50-99
Consolidated Latex Paint	100	100

The EPA recommends that procuring agencies such as LaRC use the U.S. General Services Administration's (GSA's) specification TT-P-2846 Latex Paint (Recycled with Post-Consumer Waste). This specification applies to interior and exterior latex paints intended for use on wallboard, concrete, stucco, masonry, and wood. The GSA also has a variety of both reprocessed and consolidated paints for procuring agencies to choose from if the TT-P-27846 Latex Paint does not meet specifications.

Issues:

- Air Emissions – Oil-based paint contains solvent materials such as xylene, methanol and petroleum distillates. Paint thinner and mineral spirits are used to thin and clean up the oil-based paint. All of these materials are volatile and a potential source for fugitive air emissions.
- Hazardous Waste – Since oil-based paint must be thinned and cleaned up with solvents, it creates hazardous waste. Solvent and oil-based paint waste is considered hazardous due to its flammability and/or toxicity.
- Cost Avoidance – Eliminating or decreasing the use of oil-based paints will eliminate or decrease the cost to buy solvents. Disposal costs will also decrease as non-hazardous waste is less expensive to dispose of than hazardous waste.
- Worker Health and Safety – Exposure to oil-based paint and solvent fumes poses a health risk for workers.

Pollution Prevention Opportunities:

- Material Substitution – The most obvious replacement for oil-based paint is latex or water-based paint. Studies have shown that many latex paints and coatings perform just as well if not better than oil-based.

Replacing oil-based paint with latex paint would result in less fugitive air emissions, reduced hazardous waste generated and the related disposal costs, and an increase in worker health and safety.

- Affirmative Procurement – Reprocessed or consolidated latex paint was included in the EPA's Recovered Materials Advisory Notice (RMAN) in 1997. The RMAN recommends that procuring agencies such as LaRC, when purchasing latex paints, purchase these items made from postconsumer recovered materials when these items meet applicable specifications and performance requirements.

Project Status:

Since 1992, the painting support contractor has gradually switched over to aqueous-based paint for projects involving interior and exterior painting of buildings (the painting contractor no longer has the two sections, Facility Maintenance and Corrosion Control). Currently, the painting support contractor is using aqueous-based paints for approximately 90% of their projects that involve painting surfaces such as wallboard, concrete and wood. However, the contractor still uses solvent-based paint and coatings for special projects such as painting wind tunnels. An alternative, water-based product that meets the specifications for corrosion control has not yet been found. Testing of alternative products for corrosion control projects should still be considered.

In 1999, the painting support contractor agreed to do a pilot project with reprocessed latex paint to see if it performed as well as virgin latex paint. The EMO purchased several 5-gallon containers of reprocessed paint for the project. The contractor found the paint to be unsatisfactory. It did not cover well and there were solids at the bottom of the containers that would not dissolve when mixed.

No further progress was made on this project. Although the first test of reprocessed paint was not very successful, additional tests should still be performed since there are many different specifications of reprocessed paint.

Timeline:

Throughout FY02 – Continue testing products and processes until an acceptable alternative to oil-based paint is found.

PROJECT DESCRIPTION:**Air Pollution Prevention****Product: Compliance with State Operating Permit**

Criteria (Maximum Score Possible)		Considerations
Compliance (100)	100	<ul style="list-style-type: none"> The Center must comply with enforceable conditions contained in the State Operating Permit. The production and use of ODSs are regulated by the Montreal Protocol and the CAA Amendments of 1990. Reduced emissions of air pollutants will minimize annual air pollutant emission fees imposed by the Virginia DEQ. Reduced air pollutant emissions will minimize impact on environment.
Mission Impact (40)	20	
Cost (30)	30	
Environmental Benefits (20)	20	
Liability (50)	45	
Implementation (100)	50	
Labor Intensity (100)	50	
Builds Environmental Infrastructure (100)	100	
Total (540)	415	

Background:

NASA LaRC is a generator of air pollutants defined and regulated under the Clean Air Act (CAA). A State Operating Permit issued by the Virginia Department of Environmental Quality (DEQ) contains enforceable air emission limits that apply to operations at the Center. Ozone depleting substances (ODSs) are also used at the Center. The production and use of ODSs are regulated by the Montreal Protocol and the CAA Amendments of 1990.

Air pollutants such as NO_x, SO₂, CO, PM, and VOCs are emitted from several processes including fuel combustion, spray painting, and arc-heated tunnel operation. The primary sources of air pollutants are exhausts from combustion sources such as boilers, furnaces, emergency diesel generators, and combustion tunnels (ex. 8-Foot High Temperature Tunnel). Other sources of air emissions include space heaters, portable air compressors, and mobile sources such as fleet vehicles. The biggest contributor to NASA LaRC air emissions is the Bldg. 1215 Steam Plant boilers.

Issues:

Annual air pollutant emissions at NASA LaRC are well below their permitted limits. There are no regulatory activities driving a reduction in air pollutants at LaRC. However, maintaining compliance with all conditions contained in the State Operating Permit is critical to environmental success.

- Air Permit Compliance – In order to demonstrate compliance with air permit requirements, LaRC is required to maintain records of all emission data and operating parameters. These records include monthly fuel throughput, number of operating hours and runs, and material throughput. The permit also requires that written operating procedures and maintenance schedules are developed, maintained, and made available to all operators.

- Permitting Evaluations for New Emission Units – Occasionally, new equipment at LaRC is purchased and procured without Environmental Management Office (EMO) review. In order to properly identify and evaluate air permitting issues with new or modified equipment, early involvement from EMO is needed.
- Annual Emission Fees – Annual emission fees are assessed by the Virginia DEQ based on the quantity of air pollutants emitted. For CY2000 emissions, the Center paid \$583 in emission fees. Any reduction in air pollutant emissions will reduce our annual emission fees.
- Refrigerant Management – Refrigerant management is regulated under 40CFR82 Subpart F (Recycling and Emissions Reduction). Refrigerant management at LaRC is performed by a support contractor, which the EMO must work closely with in order to ensure compliance with these regulations.

Pollution Prevention Opportunities:

- Pre-Construction Permitting Review – It is recommended that we implement changes to the current project review process to achieve earlier involvement of EMO in new project design and planning. Since air permits are required prior to commencement of construction, earlier involvement and review by EMO will allow for timely identification and evaluation of potential air permitting issues.
- Boiler Fuel Optimization – It is recommended that the 1215 Boilers be fueled with natural gas as much as possible to minimize emissions of SO₂. Natural gas combustion produces less air pollutant emissions than #2 Fuel Oil combustion.
- Steam Optimization from Hampton Trash Plant – It is recommended that we continue to support the Steam Optimization and Utilization Project (SOUP) team as they evaluate ideas to maximize the Center's use of waste steam from the Hampton Trash Burning plant. As we find ways to better utilize the steam generated at the trash plant, we will reduce the steam demand on the 1215 Steam Plant boilers and NASA LaRC air emissions will be reduced.
- Training/Outreach – Through training and outreach activities, ensure that NASA LaRC employees who operate permitted emission units understand the permit requirements and record keeping requirements pertaining to permitted equipment.

Project Status:

In FY01, emissions of criteria pollutants (NO_x, SO₂, CO, PM₁₀) and VOC totaled 45,990 pounds. The Center exceeded its 45,000-pound internal goal primarily because high natural gas costs and the curtailment of natural gas supply in the Winter of 2000 caused the Steam Plant boilers to switch to #2 fuel oil burning, which resulted in increased SO₂ emissions from the Center. The energy forecast from the NASA LaRC Utilities Manager suggests that we will not experience natural gas curtailment this Winter. If this forecast is correct, the Center will not be forced to burn #2 fuel oil in the Steam Plant boilers and annual boiler emissions should be less than last year. Unless there is a dramatic change in research activities at NASA LaRC in FY02, other emissions of criteria pollutants are expected to be about the same as in FY01.

In FY02, the Center plans to install a new combustion unit at Bldg. 1199 (hot water boiler) which will emit air pollutants. There is also a plan to install a natural gas fired heater system in Bldg. 1275 which will produce air pollutant emissions. The new heater system has been added to the State Operating Permit.

Timeline:

Throughout FY02 – Continue to maintain records of all emission data and operating parameters necessary to ensure compliance with State Operating Permit. Also, continue to support the efforts of the SOUP team.

PROJECT DESCRIPTION:**Alternatives to CFC Cleaning of Oxygen Systems****Product: Alternatives to CFC Cleaning of Oxygen Systems**

Criteria (Maximum Score Possible)		Considerations
Compliance (100)	90	<ul style="list-style-type: none"> • CFC-113 is used for the cleaning and verification processes because to date there is no viable alternative. • The use and production of CFC-113 is strictly regulated by the Montreal Protocol and the Clean Air Act Amendments of 1990. • The cost of CFC-113 has increased dramatically as production of CFC-113 has decreased.
Mission Impact (40)	10	
Cost (30)	7	
Environmental Benefits (20)	20	
Liability (50)	30	
Implementation (100)	45	
Labor Intensity (100)	50	
Builds Environmental Infrastructure (100)	50	
Total (540)	302	

Background:

CFC was commonly used to clean wind tunnel components prior to 1994. Since then, the Center has substantially reduced CFC-113 use. However, CFC-113, is still used as a cleanliness verification solvent for precision cleaning of oxygen system components used in wind tunnels because to date there is no viable alternative. CFC-113 is used mainly to clean the liquid oxygen injection ring in the 8-Foot High Temperature Tunnel where it is used, captured, distilled and reused.

Issues:

The Montreal Protocol and the Clean Air Act Amendments of 1990 strictly regulate the use and production of CFC-113 and other ozone depleting compounds. The issues associated with the use of CFC-113 at NASA LaRC are as follows.

- Alternatives to CFC-113 - The Facilities and Systems Support Division (FSSD) has replaced CFC-113 with aqueous cleaning for cleaning the oxygen system components. However, despite substantial research into alternatives they have been unable to find a technically acceptable alternative to CFC-113 for cleaning the oxygen injection ring and associated piping and as a cleanliness verification solvent.
- Availability of CFC-113 - The cost of CFC-113 has increased dramatically as production of CFC-113 has been stopped. In addition, CFC-113 is very difficult to obtain since the Department of Defense has taken a lot of the reserves.

Alternatives to CFC Cleaning of Oxygen Systems

- Other uses of CFC-113 - CFC-113 is still used for flight hardware applications and for materials that are incompatible with water. NASA LaRC investigated the water and total organic carbon analysis verification method but was unable to achieve acceptable results.

Pollution Prevention Opportunities:

- Alternative to CFC-113 - Finding a non-CFC cleaning verification solvent or method will reduce the use of CFC-113 at NASA LaRC. Finding an alternative cleaning substance for the liquid oxygen system injection ring will further reduce CFC-113 use. This project involves researching and testing alternative cleaners and cleanliness verification methods. Given the technical nature of this project, the Facilities and Systems Support Division has the lead in testing and accepting any alternative method(s).
- Joint Group for Pollution Prevention (JG-PP) Opportunity – The JG-PP is a DOD and NASA effort to identify common pollution prevention projects that are too expensive to research and implement as an individual installation but could benefit from joint efforts. The JG-PP has undertaken the CFC-113 cleanliness verification project and has begun research on possible alternatives.

Project Status:

NASA LaRC has a stockpile of CFC-113. Currently, there are no LaRC personnel investigating alternatives since the priority is low due to the inventory on hand. However, the supply is not inexhaustible which makes finding an alternative cleaning verification solvent or method important.

FSSD has previously worked with commercial chemical manufacturing companies to identify and test alternative products. FSSD sent 3M corporation some dirty parts to see if a 3M hydrofluoroether (HFE) solvent would clean them adequately. 3M reported that the HFE adequately cleaned the parts. FSSD did an independent test and concluded that HFE did not adequately clean the parts.

Kennedy Space Center has adopted HFE as an alternative cleaning verification solvent to replace CFC-113. FSSD tested HFE as a cleaning verification solvent and found it did not adequately put hydrocarbons into solution and was therefore judged to be an unacceptable verification replacement. Equipment captures the CFC-113 used during the cleaning verification process and is recycled and reused as a verification solvent. FSSD continues to investigate alternative verification solvents as they become available.

JG-PP has a large working group established for developing and testing a non-ODC oxygen line cleaning joint test protocol. The Joint Test Protocol (J-99-CL-015-P) for Validation of Alternatives to Ozone Depleting Chemicals Used in Oxygen Line Cleaning can be found through NASA HQ or JG-PP.

Timeline:

Throughout FY02 – Keep abreast of technological changes in verification methods and CFC alternatives.

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Appendix C
Identified Pollution Prevention Projects

The projects included in this section have been identified as candidates for implementation. Time and resource constraints have prevented and limited the opportunities to implement some of these projects at this time. The relative priority has changed as compliance issues and projects that require immediate attention have been given greater priority. Some projects indicate they are scheduled for implementation in FY02. At implementation, the project will become active and a full write-up will detail the project and be included in the Pollution Prevention Plan.

As new projects are added and existing projects are updated or completed, the Pollution Prevention Plan becomes more voluminous. To minimize the size of the Pollution Prevention Plan document, Table C-2 provides a project description summarizing the objective and proposed schedule for the identified projects. The following table provides project ranking data based on criteria described in Section 2.3 of the Plan.

**Table C-1
Identified Pollution Prevention Project Rankings**

Proj #	Title	C-N/C	Total Score	C-N/C	Liab	MI	Cost		Env Ben	EI	LE	Infra
							Inv	Pbk				
111	Affirmative Procurement Web-Based Training	C	431	90	30	20	12	9	20	80	80	90
115	1229A Rinsewater Recycling	N/C	405	50	20	25	20	20	30	75	75	90
114	Beneficial Landscaping	N/C	383	50	20	25	18	5	25	80	70	90
21	Storm Water Management	C	368	100	50	20	7	0	16	75	50	50
29	Energy Conservation	N/C	351	37	10	25	18	20	15	90	86	50
50	Paper and Cloth Towel Assessment	C	296	20	25	20	8	7	11	92	83	50

Table C-2
Identified Pollution Prevention Projects

Project No.	Project Name	Information on Identified Projects
21	Storm Water Management	LaRC operates under a Virginia Pollutant Discharge and Elimination System (VPDES) permit that regulates storm water discharges at the Center. A Storm Water Management Plan would provide best management practices for areas at the Center that contribute to pollution of the storm water.
29	Energy Conservation	Energy conservation at the Center has not been a priority because overall, the low cost of electricity makes it harder for reduction efforts to be cost effective. However, the Center must still meet Federal reduction goals for its Non-Mission Variable and Energy Intensive facilities. Energy conservation has been improved through the implementation of energy efficient projects and increased public awareness. The Center will conduct energy audits in FY02 to identify opportunities to conserve energy. For more information see Section 4.7.
50	Paper and Cloth Towel Assessment	Contaminated solvent and oily rags are used throughout the Center and are discarded as a hazardous or non-hazardous waste. Participating in a shop towel-laundering program could reduce the amount of waste being shipped off-site, which would also save the Center money. Further investigation of the feasibility of this project will be completed in FY02.
111	On-line Training Development	Computer-based training for the LaRC internal web has been identified as an outreach and education opportunity. Affirmative procurement training could be offered on-line for all Center personnel. The proposed course is Web based with a descriptive narrative on affirmative procurement regulations and guidance. On-line training opportunities will be evaluated by the EMO and determined if feasible for implementation.
114	Beneficial Landscaping	Beneficial landscaping practices must be implemented at the Center in order to comply with EO 13148. A Beneficial Landscaping Web site has been created and posted on the EMO Pollution Prevention Web page. The site provides information about beneficial landscaping and projects that the Center may implement in the Spring of FY02. Refer to Section 4.10 for more information on Beneficial Landscaping.
115	1229A Rinsewater Recycling	The Metals Cleaning Laboratory located in Bldg. 1229A generates a contaminated rinsewater stream which must be disposed of as waste because the Center's Hampton Roads Sanitation District (HRSD) permit regulates discharges. The rinsewater is currently collected in drums and is shipped out for treatment. This project will investigate and evaluate options for recycling and reuse of this rinsewater.

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Appendix D

Completed Pollution Prevention Projects

Appendix D is a compilation of completed pollution prevention projects at NASA Langley Research Center. Each project number, name, and summary of information is included in Table D-2.

As new projects are added and existing projects are updated or completed, the Pollution Prevention Plan becomes more voluminous. To minimize the size of the Pollution Prevention Plan document, each project description listed in Table D-2 refers the reader to the Pollution Prevention Plan in the year it was implemented in order to find detailed background information on the project. The following table provides project ranking data based on criteria described in Section 2.3 of the Plan.

Table D-1
Completed Pollution Prevention Project Rankings

Proj #	Title	C-N/C	Total Score	C-N/C	Liab	MI	Cost		Env Ben	EI	LE	Infra
							Inv	Pbk				
113	Outfall No. 009 Assessment	C	495	100	45	35	15	15	20	85	85	95
84	Paint Stripper Alternative	C	481	100	50	30	6	0	20	100	100	75
60	Gas Cylinder Tracking Program	C	460	95	48	40	12	15	15	70	70	95
104	CFC Conversions	C	462	100	47	17	8	15	20	80	85	90
75	Magnetic Drum Separator Implementation	C	448	100	50	20	12	11	20	100	85	50
2	Oil Usage Study	C	447	100	50	40	7	15	10	75	50	100
99	Conversion of Steam Plant Boilers	C	446	80	37	20	4	10	20	85	95	95
3	Electroplating Assessment	C	444	85	40	40	14	10	20	75	80	80
68	Hydraulic Fluid Analysis Program	C	440	95	50	25	8	12	20	80	75	80
4	Common Solvents Management	C	440	100	50	30	15	15	20	75	60	75
85	Varsol Alternatives	C	440	100	50	30	15	15	20	75	60	75
5	Standard Operating Procedures	C	432	87	50	25	15	5	15	70	75	90
103	Depainting of Aircraft Wheels	C	430	90	45	20	5	0	20	75	80	95
6	Towpreg Study	N/C	430	50	10	30	20	15	15	100	100	90
7	Waste Segregation SOP	C	430	88	40	20	15	15	17	95	85	85
8	Photoprocessing Assessment	C	430	100	50	34	8	12	15	75	86	50
9	Environmental Coordinators	C	430	100	50	20	15	7	18	65	55	100
74	Solvent Distillation Implementation	C	428	90	45	20	10	8	20	95	90	50
10	Promotional Program/Awareness	N/C	426	40	15	25	20	15	27	98	87	99
81	Ethylene Glycol Alternatives	C	423	95	47	20	9	13	19	85	85	50
80	Methyl Ethyl Ketone Alternatives	C	417	97	50	17	7	9	20	82	85	50
82	Toluene Alternatives	C	416	95	50	20	7	9	20	82	83	50
107	Car Wash Assessment	N/C	415	43	40	25	2	8	27	92	93	85
79	Glycol Ether Substitution	C	414	95	45	20	7	9	18	85	85	50
83	Methylene Chloride Alternatives	C	410	95	47	18	7	9	18	83	83	50
76	Double-sided Copiers	N/C	399	45	0	25	10	9	30	100	100	80
92	Lubricant Filtration System	N/C	399	35	12	25	10	15	27	95	90	90

Table D-1 (cont.)
Completed Pollution Prevention Project Rankings

Proj #	Title	C- N/C	Total Score	C- N/C	Liab	MI	Cost		Env Ben	EI	LE	Infra
							Inv	Pbk				
101	Paint Gun Washer Assessment Implementation	N/C	398	40	40	25	20	2	26	90	82	73
15	Solid Waste Source Reduction	N/C	390	45	10	25	17	19	25	82	77	90
93	Operating Procedures for Specific Cases	N/C	387	40	10	25	15	17	25	85	80	90
90	Building 1225 Assessment	C	385	60	30	15	15	15	15	80	80	75
86	Various HAP Alternatives	C	381	95	50	15	7	9	20	70	65	50
69	Material Substitution for HAPs	C	381	95	50	15	8	8	20	70	65	50
16	Lab Pollution Prevention Training	N/C	377	50	12	30	15	10	20	85	80	75
17	Alumina Study	N/C	375	50	10	25	15	15	10	100	100	50
18	Commodities Exchange Program	N/C	372	50	12	35	10	15	20	85	60	85
19	Silver Recovery Assessment	C	372	77	40	20	10	11	17	67	70	60
72	Environmental Coordinators Database	N/C	372	40	2	25	15	10	10	80	90	100
20	Grounds Maintenance SOP	N/C	369	25	10	25	18	10	30	98	85	68
87	Low Mercury Fluorescent Tube Program	C	366	60	35	25	15	15	16	75	75	50
22	Memo Strategy	N/C	364	25	10	25	18	10	16	90	90	80
24	General Wind Tunnel Study	C	363	85	30	20	10	7	16	70	65	60
25	Storage Tank Study	C	362	50	46	20	7	8	19	77	70	65
27	Chemical Exchange	N/C	356	50	15	35	16	10	20	65	60	85
71	Model Office for Affirmative Procurement	N/C	340	50	25	20	13	10	12	80	80	50
33	HAZMAT Cabinet Identification	C	337	40	50	35	13	0	19	85	45	50
34	Receiving / Loading Dock Staff Training	C	336	40	45	25	15	2	13	75	71	50
35	Building 1244 Assessment	C	335	37	30	20	10	7	14	87	80	50
59	Glass and Plastic Recycling Study	N/C	335	25	45	25	7	8	25	68	57	75
36	Cutting Fluid Recycling Assessment	N/C	334	35	13	25	16	10	25	85	75	50
37	Guidelines for Erosion and Sediment Controls	C	330	30	10	25	15	10	30	75	85	50
38	Materials Review	N/C	328	40	20	21	20	17	20	50	75	65
26	Cooling Tower Assessment	C	327	45	30	20	15	10	12	65	80	50
39	Wildlife Study	N/C	325	45	20	25	15	10	30	60	50	70
49	Wash Water Recycling Assessment	N/C	323	35	25	20	8	5	10	85	85	50
40	New Building Energy Efficiency Standards	N/C	322	44	10	24	15	18	15	80	76	50
63	Pollution Prevention Support Building	C	320	10	50	10	0	30	20	50	50	100
41	Alternative Transportation Assessment	C	320	35	25	20	10	5	20	65	50	90
42	Absorbents Assessment	N/C	315	25	10	25	20	0	15	85	85	50
43	Common Cleaning Solvents Study	N/C	310	25	30	25	5	10	20	75	70	50
65	Electrowinning at the Electroplating Shop	C	310	100	50	20	10	10	20	50	50	0
44	Print Shop Assessment	N/C	306	33	15	25	12	8	20	80	50	50

Table D-1 (cont.)
Completed Pollution Prevention Project Rankings

Proj #	Title	C- N/C	Total Score	C- N/C	Liab	MI	Cost		Env Ben	EI	LE	Infra
							Inv	Pbk				
46	Environmental Labeling Program	N/C	305	40	20	20	15	15	20	45	50	80
45	Solid Waste Management Training	N/C	305	46	10	25	12	3	17	70	72	50
47	Vehicle Maintenance Assessment	N/C	304	25	12	25	15	15	12	75	75	50
48	DRMO Quick Delivery Study	NC	302	18	10	25	15	15	14	88	62	50
88	Chip Wringer Assessment	C	302	50	20	15	14	11	12	60	70	50
62	EPCRA 313 TRI Chemical Reduction	C	300	100	50	10	10	10	20	50	50	0
53	Cafeteria Study	N/C	285	25	10	25	10	10	15	70	60	60
108	Assessment of Sealed Batteries	N/C	282	10	15	25	5	0	7	85	85	50
54	Energy/Water Usage Study	N/C	279	42	10	23	7	18	17	59	43	60
56	Fyrquel Study	N/C	275	10	15	20	10	10	15	75	70	50
57	Oil Compressor Assessment	N/C	272	25	11	25	10	10	16	75	50	50
91	Paper Baler Loading System Assessment	N/C	270	10	10	10	10	0	10	50	90	70
96	Jet Fuel Containment Pad	N/C	255	15	10	25	8	2	15	50	80	50
66	Automation of Tech. Library Reproduction Facility	C	220	100	0	10	10	10	10	50	30	0

Table D-2
Completed Pollution Prevention Projects

Project No.	Project Name	Information on Completed Projects
2	Oil Usage Study	This study was completed in 1996. Reuse of “refined oil” and Best Management Practices (BMP) are the two best ways to keep oil usage to a minimum and avoid waste. BMPs will be addressed in training – Project No. 28 and procurement of re-refined oil will be discussed in Project No. 102. Oil use and management at the Center is addressed in Project No. 67, the Oil Analysis Program. Additional information can be found in the 1996 Plan.
3	Electroplating Assessment	This project was discontinued in 1995 due to the closure of the electroplating complex. All printed circuit board manufacturing will be contracted out to commercial manufacturing facilities.
4	Common Solvents Management	This project was very general in nature. It was discontinued in 1996 and has been replaced by more specific projects. For more information on the specific projects refer to the following projects: Project No. 69, Project No. 74, Project No. 79, Project No. 80, Project No.81, Project No. 82, Project No. 83, Project No. 84, Project No. 85, and Project No. 86.
5	Standard Operating Procedures	Standardization of operating procedures is not feasible at LaRC and will be addressed on a case by case basis. Many procedures are discussed in the Environmental Program Manual or the Environmental Resource Document. Additional information on this project can be found in the 1995 Plan.
6	Towpreg Study	This study was completed in 1996. The final EPA report, published in August 1996, is titled <u>Advanced Composites Technology Case Study at NASA LaRC</u> . The resulting dry powder resin process out-performed the solvent-based process and produced environmental, economic, and energy use benefits.
7	Waste Segregation SOP	This project was discontinued in 1997. The Center has different facilities with various waste segregation SOPs. Standardization of these procedures is not feasible at LaRC. Many procedures are discussed in the Environmental Program Manual or on the EMO Waste Program Webpage (see Section 2.6).
8	Photoprocessing Assessment	This assessment was completed in 1992. Several opportunities for pollution prevention have been written as separate projects or eliminated due to changes in operations at the Center. Project No. 109 assesses digital photography at the Center. Additional information can be found in the 1996 Plan.
9	Environmental Coordinators	This project was completed in January 1996. Every building at LaRC has an Environmental Coordinator. The Environmental Coordinator list is updated as official change requests are sent to the EMO (See Project No. 72). The Environmental Coordinators are provided annual FEC training to ensure that they are knowledgeable of environmental compliance issues at their facilities (see Project No. 28). In addition, an Environmental Coordinator Reference Page is located on the EMO Website (See Section 2.6).
10	Promotional Program/Awareness	All training and awareness at LaRC is addressed in Project No. 28 and discussed in Section 2.6.
15	Solid Waste Source Reduction	This project was very general in nature. LaRC is implementing specific solid waste source reduction opportunities. For more information on the specific projects refer to the following: Project No. 12, Project No. 32, Project No. 61, Project No. 67, Project No. 69, and Project No. 77. Section 4.4 discusses LaRC’s solid waste diversion progress.
16	Lab Pollution Prevention Training	All training and awareness at LaRC is addressed in Project No. 28 and discussed in Section 2.6.
17	Alumina Study	The total disposal cost for spent alumina at the Center in FY01 was less than \$100 and equipment for recycling the material would be impracticable. Additional information can be found in the 1996 Plan.

Table D-2 (cont.)
Completed Pollution Prevention Projects

Project No.	Project Name	Information on Completed Projects
18	Commodities Exchange Program	All the issues identified in this assessment are addressed in other projects. For additional information refer to Project Nos. 1, 12, and 23. Information on this project can also be found in the 1996 Plan.
19	Silver Recovery Assessment	Analyses of hazardous waste disposal records indicate that only a small amount of silver-bearing photo processing waste was submitted in FY01. The silver recovery unit will be removed from service in FY02 due to changes in photo processing on the Center. Additional information can be found in the 1998 Plan.
20	Ground Maintenance SOP	The grounds maintenance support contractor implements many pollution prevention projects. Weed eradication is performed manually and minimal chemical spraying is performed. Granular fertilizers are used infrequently and pesticide containers are triple-rinsed and the rinseate is reused. NASA LaRC also has an active composting program. All shrubs, limbs and leaves are composted. Grass clippings are mulched and left on the ground to act as a fertilizer. Additional information on this project can be found in the 1996 Plan.
22	Memo Strategy	LaRC has implemented an electronic mail system to information to the Center. In addition, EMO uses their Website to disseminate environmental information (see Section 2.6). Additional information on this project can be found in 1995 Plan.
24	General Wind Study Training	All training and awareness at LaRC is addressed in Project No. 28 and discussed in Section 2.6.
25	Storage Tank Study	This project was completed in 2000. In 1998, an inventory of storage tanks at the Center was completed to include digital pictures. The Center evaluated the condition of its underground storage tanks and many were removed as they were old and/or unused. The removal project was completed in the Fall of 1999. The Center's Integrated Spill Contingency Plan (ISCP) contains a current inventory of the storage tanks at the Center and policy and procedures for proper storage tank management to include inspection and documentation procedures. The ISCP is updated periodically and is available from the EMO. Additional information on this project can be found in the 2001 Plan.
26	Cooling Tower Assessment	This assessment was completed in 1999. The assessment identified and compared three technologies to the current chemical treatment practice used to maintain cooling towers on the Center. Ozone treatment, ion exchange, and sand filtration were the technologies investigated and reported in the assessment. The assessment was used to increase awareness by identifying considerations, observation and findings, and best management practices of each cooling tower technology. The assessment is titled <u>Cooling Tower Technology Assessment</u> and is available through EMO or the Facility Support Engineering Division (FSED).
27	Chemical Exchange	This project was completed in 1998. A self-contained building has been purchased for storage of excess materials (See Project No. 61). An inventory search feature has been set up through the Chemical Material Tracking System to allow all Center personnel to access inventory data.
33	HAZMAT Cabinet Identification	The Chemical Material Tracking System (See Project No. 1) captures the location of chemicals used and stored on the Center. Additional information on this project can be found in the 1996 Plan.

Table D-2 (cont.)
Completed Pollution Prevention Projects

Project No.	Project Name	Information on Completed Projects
34	Receiving/Loading Dock Staff Training	It was decided that LaRC would not implement a hazardous material handling and storage program for loading dock personnel. The issue of incompatible materials being stored improperly is being addressed by the Office of Logistics Management and their contractor. Additional information on this project can be found in the 1995 Plan.
35	Building 1244 Assessment	The assessment identified many opportunities such as chemical substitutions, wash water recycling, the improvement of jet fuel containment, and HVAC improvement. Refer to the following specific projects for more information: Chemical substitutions (Project Nos. 79-83, 85,86); Wash water recycling (Project No. 49); Jet Fuel Containment (Project No. 96); and Depainting of aircraft wheels (Project No. 103). Additional information on this project can be found in the 1996 Plan.
36	Cutting Fluid Recycling Assessment	LaRC has chosen not to pursue any additional assessments of cutting fluid recycling alternatives at this time. Building 1225 recirculates their cutting fluids. Additional information can be found in the 1995 Plan.
37	Guidelines for Erosion and Sediment Controls	Guidelines for erosion and sediment control can be found in NASA LaRC's SPECSINTACT. For updated information on contract specifications refer to Project No. 30 and Project No. 21. Additional information on this project can be found in the 1996 Plan and will be addressed in Project No. 114.
38	Material Review	The Hazardous Material Purchase Approval Form (Form 44) and the Radiation Purchase Approval Form (Form 44A) have been automated and are included in the Chemical Material Tracking System (see Project No.1). Safety Heads, industrial hygienists, the Environmental Manager, and Facility Environmental Coordinators review all forms prior to purchasing for environmental and safety concerns. Additional information on this project can be found in the 1996 Plan.
39	Wildlife Study	Old Dominion University conducted a wildlife study in September 1994 at NASA LaRC. The study, <u>Baseline Biological Survey of Terrestrial and Aquatic Habitats at NASA LaRC, with Special Emphasis on Endangered and Threatened Fauna and Flora</u> , concluded that there are no wildlife concerns at the Center. Additional information on this project can be found in the 1996 Plan. An updated study may be conducted in the future.
40	New Building Energy Efficiency Standards	Executive Order 13123, in conjunction with Section 161 of the Energy Policy Act of 1992, established mandates for Federal agencies to increase energy efficiency at their facilities (see Section 4.7 and Appendix E). The Center has an Energy Efficiency Team that identifies and implements opportunities to conserve energy. This project will be incorporated into Project No. 29.
41	Alternative Transportation Assessment	The assessment for alternative transportation was completed in 1996 and was superseded by Project No. 89 – Alternative Fueled Vehicles. The Center should continue to promote ride-sharing and bicycling to work as alternative means of transportation.
42	Absorbents Study	Facilities are given reusable absorbent pads and pig squeezers (a device that sits on top of a 55-gallon drum and drains reusable absorbent pads). Absorbent waste material is continuously monitored in order to identify opportunities for the reusable pads and equipment. Additional information on this project can be found in the 1996 Plan.
43	Common Cleaning Solvents Study	Issues identified in this study were addressed by specific projects targeting solvents. This Plan addresses hazardous material usage reduction efforts in Project No. 32. Additional information on the study can be found in the 1996 Plan.

Table D-2 (cont.)
Completed Pollution Prevention Projects

Project No.	Project Name	Information on Completed Projects
44	Print Shop Assessment	The printing presses and associated equipment and chemicals have been removed from the LaRC Print Shop. Offset printing is no longer conducted at this facility, only in-house copying. Any offset printing required by LaRC is performed through the Government Printing Office offsite.
45	Solid Waste Management Training	All training and awareness at LaRC is addressed in Project No. 28 and discussed in Section 2.6.
46	Environmental Labeling Program	Product labeling functionality has been incorporated into the Center's Chemical Material Tracking System (CMTS) (see Project No. 1). Additional information on this project can be found in the 1994 Plan.
47	Vehicle Maintenance Assessment	This assessment was completed in 1995. Several specific projects have been implemented to prevent and reduce waste. Refer to the following projects for more information: Project No. 2, Project No. 31, Project No. 52, and Project No. 67. Additional information on this project can be found in the 1996 Plan.
48	DRMO Quick Delivery Study	As of October 1, 1995, LaRC stopped using DRMO. Therefore, the project has been discontinued.
49	Wash Water Recycling Assessment	This assessment was completed in 1995. The Center allocated funds for implementation of an aircraft wash water recycling unit at Building 1244. The aircraft wash water-recycling unit was installed in FY01. Additional information on this assessment can be found in the 1996 Plan.
53	Cafeteria Study	This project is very general in nature. For information on the specific projects refer to the following projects: Project No. 49, Project No. 54, Project No. 58, and Project No. 59. Additional information can be found in the 1996 Plan.
54	Energy/Water Usage Study	This project has been incorporated under Project No. 29 – Energy Conservation and Project No. 106 – Water Conservation.
56	Fyrquel Study	The Fyrquel Study was completed in 1995. LaRC received the <u>Program of Engineered Services and Product Supply for Lubrication Requirements</u> report from Papco/Mobil on oil use and management at the Center in late 1994. No follow-up action was pursued directly as a result of this report, but issues are addressed in Project No. 57, the Oil-Sealed Vacuum Pump Assessment, and Project No. 67, the Oil Analysis Program.
57	Oil Compressor Assessment	This assessment was completed in 1996. The EMO purchased and installed oil-mist capturing Smoke Arrestors. This control equipment proved to be incompatible with the Fyrquel oil and negatively impacted the performance of the vacuum pumps. The installation of a steam ejector has decreased the load and use of the vacuum pumps. Refer to the 1996 Plan for additional information.
59	Glass and Plastic Recycling Study	This study was completed in 1999. Based upon current generation rates and market value for the glass and plastic, the EMO determined that collection of these materials would be an economic loss. Details of the study are available through EMO in the <u>Glass and Plastic Assessment</u> .
60	Gas Cylinder Tracking Program	The Chemical Material Tracking System (see Project No. 1) has been modified to meet gas cylinder tracking requirements for both the EMO and Office of Logistics Management (OLM). Gas cylinder tracking functions were operational in Fall of 1998. These functions reduce duplicate efforts by OLM and facility personnel and allow OLM to better track rental gas cylinders. In addition, this will allow the EMO to more easily compile EPCRA reports. Additional information on this project can be found in the 1999 Plan.

Table D-2 (cont.)
Completed Pollution Prevention Projects

Project No.	Project Name	Information on Completed Projects
62	EPCRA 313 TRI Chemical Reduction	Lead was reported on Form R for RY00. Documentation for the Center's EPCRA Section 313 report, <u>EPCRA Toxic Release Inventory Documentation for RY 2000</u> (dated June 2001), is available through EMO. Future TRI chemical reductions will be monitored under Project No. 32 – Hazardous Materials Usage Analysis.
63	Pollution Prevention Support Building	This project was completed in 1996 upon construction completion of the building. The equipment housed in the Pollution Prevention Support Building may change as projects are identified in order to support the pollution prevention and recycling programs.
65	Electrowinning at the Electroplating Shop	This project was discontinued in 1995 because Building 1270 was shut down.
66	Automation of Technical Library Reproduction Facility	The technical library staff determines the activities for this project and feel it is more used to enhance library services and not necessarily to reduce paper use. Additional information can be found in the 1998 Plan.
68	Hydraulic Fluid Analysis Program	This project is incorporated in Project No. 67 – The Oil Analysis Program. Hydraulic systems are included in the oil analysis database and savings and waste reduction are tracked as a part of the Oil Analysis Program. Additional information on this project can be found in the 1999 Plan.
69	Material Substitution for HAPs	Projects targeting specific HAPs for material substitution were addressed in Project Nos. 79-85. This Plan addresses hazardous material usage reduction efforts in Project No. 32. Additional information on this project can be found in the 1998 Plan.
71	Model Office for Affirmative Procurement	This project was completed in 2000. Office products were evaluated and incorporated into the LaRC on-line procurement system. Information on affirmative procurement and its implementation is discussed in Section 3.3, Section 4.5, and Appendix E. Additional information on this project can be found in the 2000 Plan.
72	Environmental Coordinators Database	The Environmental Coordinators Database was created in January 1996. Information is updated when official notices of changes are sent to the EMO. The database is accessible to all Center personnel and contractors through the EMO Website and the Langley internal Website. (see Section 2.6.2)
74	Solvent Distillation Implementation	This project was completed in 2000. The composites and Polymer Lab acquired the distillation unit to reclaim N-methyl-2-pyrrolidinone and other solvents. Additional information on this project can be found in the 2000 Plan.
75	Magnetic Drum Separation	According to the on site painting contractor, they do not generate enough paint waste to warrant the use of the equipment. Success of this project depends on the on site contractor using the separation unit for paint removal operations. Additional information can be found in the 1998 Plan.
76	Double-sided Copiers	All copiers on the Center, with the exception of the smallest models, are capable of making double-sided copies. Additional information on this project can be found in the 1996 Plan.
79	Glycol Ether Substitution	Glycol ether was targeted as a chemical for usage reduction and substitution because it is listed as a hazardous air pollutant under the 1990 Clean Air Act Amendments (CAAA). All future substitution of hazardous chemicals will be addressed in Project No. 32 – Hazardous Materials Usage Analysis. More information on this project can be found in the 2001 Plan.

Table D-2 (cont.)
Completed Pollution Prevention Projects

Project No.	Project Name	Information on Completed Projects
80	Methyl Ethyl Ketone Alternatives	Methyl ethyl ketone was targeted as a chemical for usage reduction and substitution because it is a hazardous air pollutant and listed as a toxic chemical under EPCRA. All future substitution of hazardous chemicals will be addressed in Project No. 32 – Hazardous Materials Usage Analysis. More information on this project can be found in the 2001 Plan.
81	Ethylene Glycol Alternatives	Ethylene glycol was targeted as a chemical for usage reduction and substitution because it is listed as a hazardous air pollutant under the CAA. All future substitution of hazardous chemicals will be addressed in Project No. 32 – Hazardous Materials Usage Analysis. More information on this project can be found in the 2001 Plan.
82	Toluene Alternatives	Toluene was targeted as a chemical for usage reduction and substitution because it is a hazardous air pollutant and listed as a toxic chemical under EPCRA. All future substitution of hazardous chemicals will be addressed in Project No. 32 – Hazardous Materials Usage Analysis. More information on this project can be found in the 2001 Plan.
83	Methylene Chloride Alternatives	Methylene chloride was targeted as a chemical for usage reduction and substitution because it is a hazardous air pollutant and listed as a toxic chemical under EPCRA. In FY01, facility personnel tested alternatives for methylene chloride-containing gasket removers, but no drop-in replacement has been chosen. All future substitution of hazardous chemicals will be addressed in Project No. 32 – Hazardous Materials Usage Analysis. More information on this project can be found in the 2001 Plan.
84	Paint Stripper Alternative	The non-hazardous coating remover, Prep Rite, was successfully tested by the support contractor, and determined to be a viable alternative from cost, environmental, and safety perspectives. As a result, the support contractor no longer purchases or uses hazardous paint stripper. Additional information on this project can be found in the 1998 Plan.
85	Varsol Alternatives	Varsol contributes to air pollution and contains chemicals that are regulated under EPCRA and the CAAA. Varsol is mainly used in hand cleaning and parts washing operations on the Center. Parts washers containing varsol are being replaced with aqueous-based models. Additional information about parts washer replacement can be found in Project No. 31. All future substitution of hazardous chemicals will be addressed in Project No. 32 – Hazardous Materials Usage Analysis. More information on this project can be found in the 2001 Plan.
86	Various HAP Alternatives	Due to the small quantities of these chemicals in use at the Center, this project was discontinued in 1998. Specific HAP alternatives projects have been developed and targeted for materials with higher usage. Projects targeting specific HAPs for material substitution were addressed in Project Nos. 79-85. This Plan addresses hazardous material usage reduction efforts in Project No. 32. Additional information can be found in the 1998 Plan.
87	Low Mercury Fluorescent Tube Program	A program was established to implement the use of low mercury fluorescent tubes at the Center. Additional information on this project can be found in the 1996 Plan.
88	Chip Wringer Assessment	This assessment was completed in 1997. The price for the chip wringer unit was unreasonable for the amount of waste generated. Additional information on this project can be found in the 1996 Plan.
90	Building 1225 Assessment	The assessment was completed in August 1997. Several identified opportunities have been implemented, including partial recovery of coolant from metal shavings with absorbent pads and a loading ramp for the spill control pallets. Additional information on this project can be found in the 1998 Plan.

Table D-2 (cont.)
Completed Pollution Prevention Projects

Project No.	Project Name	Information on Completed Projects
91	Paper Baler Loading System Assessment	This assessment was completed in 1997. The EMO installed a paper cart dumping system in 1997 in order to provide safe operation of the horizontal baler. Additional information on this project can be found in the 1998 Plan.
92	Lubricant Filtration System	The decantation tank used to filter the lubricant was installed in June 1995 and is currently functioning in Building 1225. Additional information on this project can be found in the 1998 Plan.
93	Operating Procedures for Specific Cases	The Environmental Program Manual states the Center's policy and responsibilities for all environmental program areas. Additional information on this project can be found in the 1999 Plan.
96	Jet Fuel Containment Pad	This project was completed in 1996. The jet fuel containment pad will help meet the goals of the Center's Spill Prevention Control and Countermeasure Plan. Additional information on this project can be found in the 1998 Plan.
99	Boiler Modifications at the Steam Plant	The modifications were completed in May 1998. Three of the four boilers can burn either fuel oil or natural gas, while the fourth boiler burns only natural gas. The modifications also included the installation of low nitrogen oxide (NOx) emitting burners and flue gas recirculation systems to minimize air emissions. This modification project ensures LaRC will be able to generate the steam it requires without significant additional air emissions. Additional information on this project can be found in the 1999 Plan.
101	Paint Gun Washer Assessment and Implementation	This project was completed in FY01. A survey of facilities that use spray guns was conducted. It was determined that only five facilities use spray paint guns, and of those five, one facility is already using a paint gun washer. There is also another paint gun washer on Center that is operable, but not being used. Should a facility require a paint gun washer in the future, the paint gun washer can be transferred. At this time, no additional paint gun washers are needed.
103	Depainting of Aircraft Wheels	Investigation and documentation states plastic bead blasting is an acceptable technique for depainting aircraft wheels. The chemical dip tank process used to strip aircraft wheels is no longer used and the wheels are sent off-site for depainting. Additional information on this project can be found in the 1999 Plan.
104	CFC Conversions	At the Transonic Dynamic Tunnel (TDT), a large-scale, sub-atmospheric wind tunnel with transonic aeroelastic testing capabilities, CFC-12 was replaced with HFC 134a in June 1996. The vast majority of CFC cleaners have been replaced with non-CFC solvents or aqueous based cleaners. The Center has improved air conditioner maintenance by improving equipment maintenance, capturing and reusing CFCs, and replacing CFCs with more ozone-friendly or non-ozone depleting refrigerants. Additional information on this project can be found in the 1999 Plan.
107	Car Wash Assessment	The assessment identified issues concerning the discharge of wash water used in the vehicle washing operations that was contaminated with oil, grease, solids and detergents. It was recommended that a closed loop wash water and filtration system be installed to eliminate contaminated wash water and decrease water consumption. The Engineering Support & Facility Projects Branch determined that it would not be economically feasible to build a closed loop wash filtration system. The study is titled <u>Car Wash Assessment</u> and is available through the EMO.
108	Assessment of Sealed Batteries	The assessment compared the lead acid automotive battery to the Optima battery. It was recommended that the Center continue the use of the current lead acid automotive battery because the Optima battery did not provide any relevant benefits to the Center and it was not cost effective. Additional information on this project can be found in the 1999 Plan.

Table D-2 (cont.)
Completed Pollution Prevention Projects

Project No.	Project Name	Information on Completed Projects
113	Outfall No. 009 Assessment	This assessment was completed in FY01. The objective of the assessment was to investigate and locate oil releases into Outfall 009. The assessment identified several buildings that could possibly be releasing oil into the outfall. Through analytical testing, Building 1247E was identified as the actual building responsible for the release. Additional information on this project and the recommendations given on how to eliminate the oil release can be obtained through the EMO.

Appendix E

Baseline Data

Appendix E provides detailed data for the environmental program areas. This section expands on the information presented in Section 4.

1.0 Hazardous Materials

The Center stores and uses various hazardous chemicals, many of which are used and stored in bulk. These chemicals must be accounted for and possibly reported based on Federal, State, and local regulations. The main source of hazardous material information is inventory reports generated by the Center's Chemical Material Tracking System (CMTS) (see Project No. 1). All Center facilities are required to track hazardous materials using CMTS as stated in NASA LaRC policy LAPG 8800.1. The CMTS allows facility personnel to track material usage by container as inventory items are added, transferred, and consumed. CMTS also allows users to enter chemicals as bulk tanks or cylinders, so these items can be easily distinguished and captured correctly for environmental reporting.

The CMTS is linked to a MSDS library that contains information about each product's constituents, CAS numbers, and physical properties. Tracking begins with the submission of a Form 44, a Hazardous Material Purchase Approval request form, which requires approval from the facility safety head, Environmental Management Office (EMO), and Safety Office prior to purchase. The Facility Environmental Coordinator is then responsible for maintaining and tracking the chemical inventory in the facility and updating the inventory quarterly using CMTS.

Research and development activities are a major use of bulk chemicals, which include fuels, gases and cleaning solvents. Bulk chemicals are good targets for pollution prevention and should be investigated. Propane is used as a fuel for research activities. Gases such as nitrogen, helium and oxygen are used in wind tunnels and other research activities because their specific properties are well suited to the tests and research being conducted. Pollution prevention opportunities for these gases are improving methods to reduce usage or implementing recycling. In areas where high volume chemical use is not driven by mission critical research, there have been significant efforts to reduce usage and pollutants generated. Refer to the following pollution prevention projects for more information: Hazardous Materials Usage Analysis (Project No. 32), Reuse of Jet Fuel JP-5 (Project No. 94), Alternatives to CFCs (Project No. 73), and Alternative Fueled Vehicles (Project No. 89).

Under section 503 of EO 13148, an interagency Workgroup drafted a list of 15 chemicals that may attribute to significant harm to human health or the environment. These chemicals were considered "priority" and are targeted for reduction and substitution for identified applications by 50% by December 31, 2006 (see Appendix G for the list of proposed chemicals). The Center will use CMTS reports to monitor these chemicals.

1.1 Environmental Reporting of Hazardous Materials

It is important that all hazardous materials, especially bulk items, are tracked properly so that accurate data is available for environmental reports. The CMTS equips the EMO with automated information to evaluate compliance with Federal, State, and local environmental regulations and policies. The environmental statute requiring hazardous material record keeping is the Emergency Planning and Community Right-to-Know Act (EPCRA). Under EPCRA, the Center must report information related to the types and quantity of chemicals stored on-site, and any spills, chemical releases or off-site transfers of toxic chemicals.

Section 312 of EPCRA requires the Center to prepare an emergency and hazardous chemical inventory, or a Tier II Report. The purpose of Tier II reporting is to provide State, local officials and the public with specific information of chemicals stored at the facility during the past year. The information in Table E.1 was derived from the Center's Tier II report for reporting year (RY) 2000, which reports storage of

hazardous materials that exceeded 10,000 pounds and extremely hazardous substances above the chemical's specified threshold. A limited number of chemicals listed under Section 312 of EPCRA were used in significant quantities at NASA LaRC during RY 2000. A copy of the complete EPCRA Tier II report can be obtained from EMO.

Table E-1
RY 2000 Hazardous Materials Reportable under EPCRA Section 312

Chemical Name	CAS Number	Major Uses of Chemical
#2 Fuel Oil	68476-30-2	Energy production
1,1,1,2-Tetrafluoroethane (HFC-134a)	811-97-2	Test gas medium for wind tunnel research
Argon	7440-37-1	Test gas for calibration
Carbon Dioxide	124-38-9	Test gas medium
CFC 113(Trichlorotrifluoroethane)	76-13-1	Precision cleaning and verification
Chlorine	7782-95-6	Cooling water treatment
Diesel Fuel	68476-34-6	Energy production
Ethylene Glycol	107-21-1	Cooling for Aircraft Landing Dynamics Facility catch mechanism
Gasoline	8006-61-9	Fuel
Helium	7440-59-7	Research and development activities
Hydrogen Chloride	7647-01-0	Research and development activities
JP-5	64742-47-8	Aircraft fuel
Lead	7439-92-1	Ingots used as weights and research and development activities
Methane	74-82-8	Fuel and research and development activities
Nitrogen	7727-37-9	Research and development activities
Oxygen	7782-44-7	Research and development activities
Propane	74-98-6	Fuel for research and development activities
Propylene Glycol	57-55-6	Antifreeze
Sodium Chloride	7647-14-5	Research and development activities
Tin	7440-31-5	Research and development activities

Section 313 of EPCRA requires facilities to publicly report their releases of listed toxic chemicals on an annual basis using a standardized "Form R". The information is compiled into a national Toxic Release Inventory (TRI). The complete CY 2000 Form R for 53,000 pounds of recycled lead and the documentation can be obtained through EMO. The lead was due to a shutdown of a facility research project.

EPA lowered its reporting thresholds for persistent and bioaccumulative toxics (PBT) chemicals in 2000, which includes lead, mercury, certain pesticides and polychlorinated biphenyls (PCBs). The Center has already eliminated the use of EPA listed PBT pesticide chemicals and PCBs on the Center. PCBs contained in transformer oil are exempt from EPCRA reporting. Since lead and mercury are still used at the Center, these chemicals will be monitored closely to ensure that EPCRA reporting thresholds are not exceeded.

2.0 Hazardous Waste

LaRC is a large quantity generator of hazardous waste (HW) under the Resource Conservation and Recovery Act (RCRA). Hazardous waste is any material that is abandoned, discarded, recycled or inherently waste-like and has:

- A. Characteristics of hazardous waste listed by the EPA in 40 CFR 261, Subpart D.
- B. Any characteristics of ignitability, corrosivity, reactivity or toxicity defined by the EPA in 40 CDR 261, Subpart C.
- C. A potential of causing damage to health or the environment if disposed of improperly or if a spill occurs.

This section describes the major waste types and the activities at LaRC that generate HW. Summary statistics of waste quantities for 1997 to 2001 are presented. Waste trends and descriptions of waste categories are provided for each fiscal year (FY).

The different types of HW are broken down into sub-categories in order to make the data easier to analyze. Table E.2 summarizes the HW generated at the Center from FY 1997 to 2001 and lists total waste both with and without paint removal and one time wastes. Exhibits E.1 through E.5 graphically illustrate the HW categories from Table E.2. The exhibits *exclude* the remediation and one-time wastes to allow for a more realistic comparison of the Center's HW generation trends.

Table E-2
Hazardous Waste Generated - Summary (Lbs.)
NASA LaRC FY 1997-2001

Type of Waste	1997	1998	1999	2000	2001
Aqueous Cleaning Solutions, Corrosive/Metals	1,771	0	605	573	1,895
Batteries	2,801	3,505	5,088	3,317	4,438
Clean up Debris	0	0	0	252	125
Compressed Gas	140	1,360 ¹	451	478	877
Contaminated Oil	4,260	619	1,496	1,185	2,266
Contaminated/Unused Fuel	2,603	4,105	3,354	2,124	2,214
Cutting/Machining Fluids	1,238	0	0	0	0
Flammable and Toxic Solvents from Facility Painting	6,011	7,581	4,945	3,000	1,516
Flammable Spent Solvents from Cleaning	1,441	1,061	1,979	0	681
Lab Packs - Acute/Toxic	93	0	5	0	6
Lab Packs - Old Chemicals	2,347	717	1,216	6,814	1,002
Lab Packs - Mixed Lab Packs	6,931	10,347	10,676	2,904	7,973
Metals from Lab Research	75	68	4	1	0
Lead Paint Remediation Wastes	13,940	27,547	11,872	7,603	22,968
Halogenated Cleaning Solvents	295	439	0	1,186	257
Spent Photochemicals	39	701	364	171	3,220
Out of Date Materials	0	584	0	440	0
Oily Water	0	1,411	0	0	0
Halogenated/Nonhalogenated Flammable Solvents (labs)	1,250	2,987	3,643	2,378	3,633
Total With Paint Remediation Wastes And One-time Wastes	45,235	63,032	45,698	32,426	53,071
Total Without Remediation and One-time Wastes	31,295	35,485	33,826	24,823	30,103

¹One-time shipment of 275 cylinders was 1,330 pounds; regular wastestream weight is 30 pounds.

The following is a brief analysis of the largest HW streams from FY 1997 to 2001. The percentages are based on the pie graphs (Exhibits E.1-E.5) and are presented in Table E.3.

2001

The total HW generated by the Center for FY 2001 was 30,103 pounds. This is an increase from FY 2000 by 5,280 pounds. The largest waste stream was Lab Packs at 33 percent. Facility personnel are encouraged by the EMO to streamline their chemical inventories so that managing them will be easier. The second largest waste stream was Batteries. The EMO over the past year has increased employee awareness about properly accumulating batteries for disposal. Facilities have separate containers for each type of battery. No paperwork is needed to turn in batteries for disposal and personnel can use the EMO website to request pickup.

The third largest waste stream was Halogenated/Nonhalogenated lab solvents at 14 percent. Much of this waste stream was generated from the Center's Aerosol Can Recycling Program (see Project No. 95). Aerosol cans, whether full or empty, are accumulated at Satellite Accumulation Areas by facility personnel. The EMO support contractor picks up the cans and uses a puncturing device to drain the residue into an accumulation container. The drum of residue is sent off site for disposal and the can is sent to scrap metal

for recycling. To decrease this waste stream, Center personnel would have to decrease use of aerosol products. Another portion of this waste stream is generated from lab research performed at facilities such as Building 1293A. The waste solvents are generated from washing glassware.

2000

The total HW generated by the Center in FY 2000 was 24,823 pounds. This is a 9,003 pound decrease from the FY 1999 total. The largest category was Lab Packs at 37 percent. Unlike previous years, the largest part of the Lab Pack waste stream was old or out of date chemicals. This was due to large facility clean outs as personnel learn to better manage their chemical inventories. In addition, Buildings 1275 and 1202 had lab shutdowns. Most of the other categories are similar to last year's percentages. The solvent categories for painting and cleaning decreased slightly because the on-site painting contractor started using non-solvent based materials.

1999

The Center generated 33,826 pounds of HW in FY 1999. This is only a slight decrease from FY 1998. Lab packs represented the largest percentage at 35 percent. Many chemicals were turned in this year as a result of the ISO 9000 audit and waste management training. Facility personnel who handle or oversee the handling of hazardous chemicals and waste are required to annually attend waste management training. This training emphasizes inventory control, proper management practices, and encourages the use of the Center's Reuse Facility.

Two categories are tied for second at 15 percent of the HW stream. They are Batteries and Flammable & Toxic Solvents from Facility Painting. The Center uses many different types of batteries in its daily operations, such as alkaline, nickel cadmium, lithium and lead acid. All of these types of batteries are collected as hazardous waste and most are sent off site for recycling. There was a slight increase in the total weight of batteries in 1999 as two facilities each turned in a large quantity of oversized batteries that were no longer usable. Compared to 1998 data, the category of Flammable & Toxic Solvents from Facility Painting decreased from 22 percent of the HW stream down to 15 percent in 1999. This decrease can be attributed to fewer painting projects conducted during FY 1999 by the on-site painting contractor's Corrosion Control work group.

1998

The Center generated 35,485 pounds of HW in FY 1998. Lab packs represented the largest percentage of the Center's HW stream at 27 percent. While the total pounds only slightly increased from last year, other categories have decreased, thus making the percentage higher. Many Lab pack chemicals were turned in for disposal in 1998 as more facility personnel have received training on proper chemical inventory maintenance (See Project No. 28 – Employee Outreach and Training). Also, in preparation for the Voluntary Protection Program OSHA visit, many facilities turned in large quantities of excess and out-of-date Lab pack chemicals. As more facility personnel receive training on proper waste management and chemical inventory procedures (See Project No. 1, Project No. 28 and Project No. 61), the total pounds should decrease over the next several years. Chemical substitution of hazardous materials with nonhazardous materials will also improve Lab pack generation (See Project Nos. 79 – 85).

Flammable and Toxic Solvents from Facility Painting was the second largest waste stream at 22 percent. This is a slight increase from 1997. LaRC's on-site painting contractor has two main work groups, Facility Maintenance Operations and Corrosion Control. While the Facility Maintenance group has switched to latex or water-based paint for almost all of its painting operations, Corrosion Control has been unable to find a suitable nonhazardous replacement for the solvent-based paint they use (See Project No. 55 – Paint and Coatings Study). In 1998, there was an increase in the number of wind tunnel and structure re-painting projects, therefore there was an increase in the amount of solvent waste generated.

The third largest HW stream in 1998 was Contaminated/Unused Fuel, representing 12 percent of the total HW stream. The main operation that contributed to this waste stream was de-fueling of aircraft at the hangar, Building 1244.

1997

The total HW generated by the Center in FY 1997 was 31,295 pounds. Lab Packs represented the largest waste stream at 30 percent. Throughout the year, facility personnel turned in numerous small chemicals and waste containers generated from research and maintenance projects. Also many chemicals were turned in that were no longer useable or past shelf life.

The second largest category was Flammable Solvents from Facility Painting at 19 percent. Several large paint remediation projects were performed during the year and the contractors used oil-based paint to recoat structures, such as wind tunnels. The third largest category was contaminated oil at 14 percent. The oil was contaminated with freon from air conditioning maintenance.

Table E.3 illustrates the percentages of HW streams generated for FY 1997 - 2001. These percentages are based on the HW categories represented in Table E.2 and the pie charts in Exhibits E.1 -E.5. Please note that the Lab pack categories have been combined.

Table E-3
Percentage of HW Generated - By Waste Stream
NASA LaRC FY 1997-2001

HW Disposal Category	1997	1998	1999	2000	2001
Aqueous Cleaning & Corrosive Metals	6	-	2	2	6
Batteries	9	10	15	13	15
Compressed Gases	-	-	-	2	3
Spent Photochemicals	-	-	-	-	11
Contaminated Oil	14	2	4	5	8
Contaminated/Unused Fuel	8	12	10	9	7
Cutting/Machining Fluids	4	-	-	-	-
Discarding Out of Date Chemicals	-	2	-	2	-
Flammable Spent Solvents from Cleaning	5	3	6	-	2
Flammable & Toxics Solvents from Facility Painting	19	22	15	12	5
Oily Water	-	4	-	-	-
Lab Packs	30	32	35	39	30
Halogenated Cleaning Solvents	1	-	-	5	-
Halogenated and Nonhalogenated Lab Solvents	4	9	11	10	12
Other*	<1	4	2	1	1

*Other for 2001: Clean-up debris and Halogenated Cleaning Solvents; 2000: Clean Up Debris, Spent Photochemicals, and Research Metals; 1999: Clean Up Debris, Compressed Gases, Research Metals, Contaminated Oil, Cutting and Machining Fluids, Spent Photochemicals; 1998: Spent Photochemicals, Research Metals, Clean up debris; 1997: Compressed gases, research metals.

Exhibit E-1
NASA LaRC FY 1997 Hazardous Waste Disposal
Excluding Remediation Waste

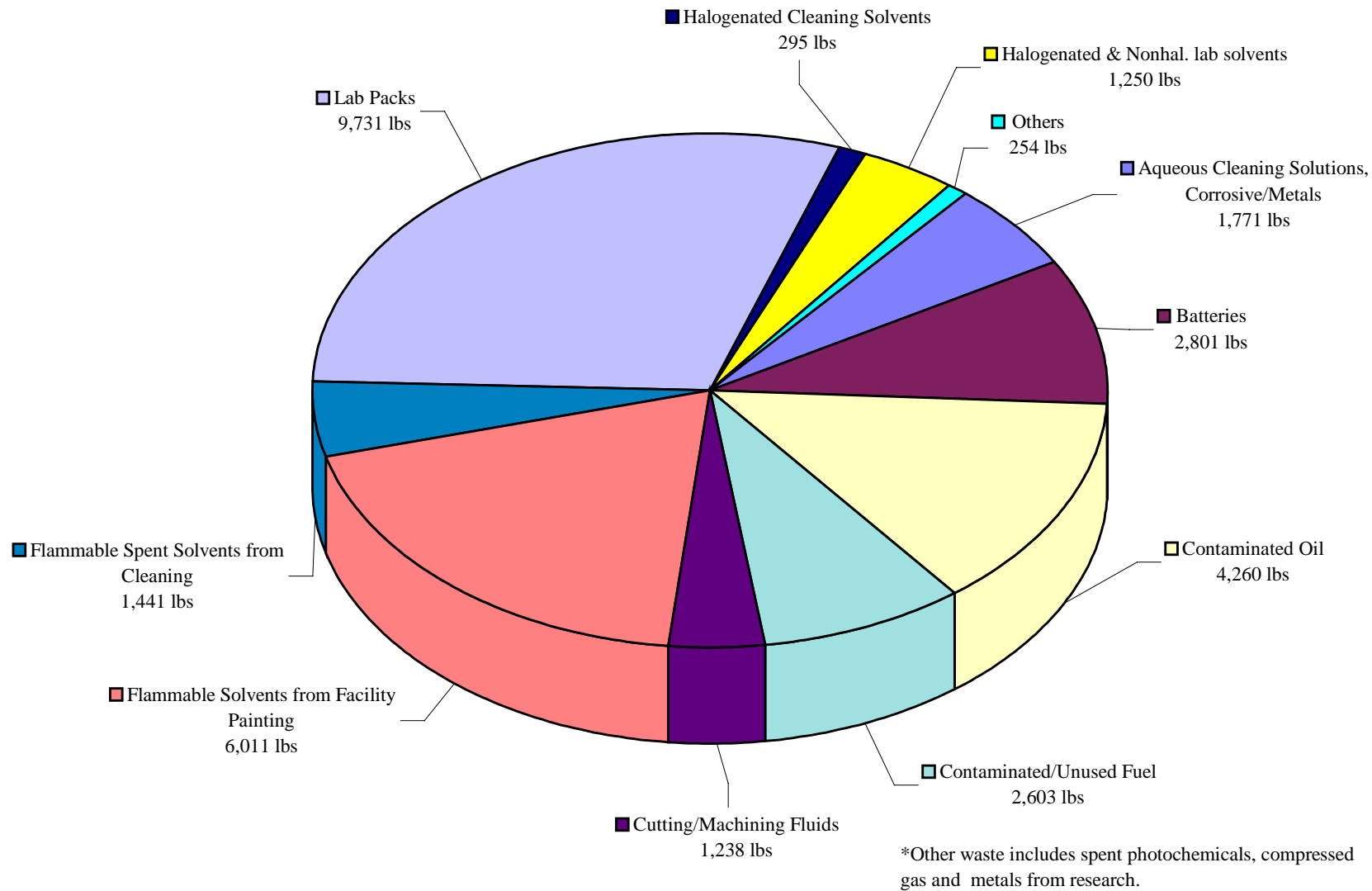
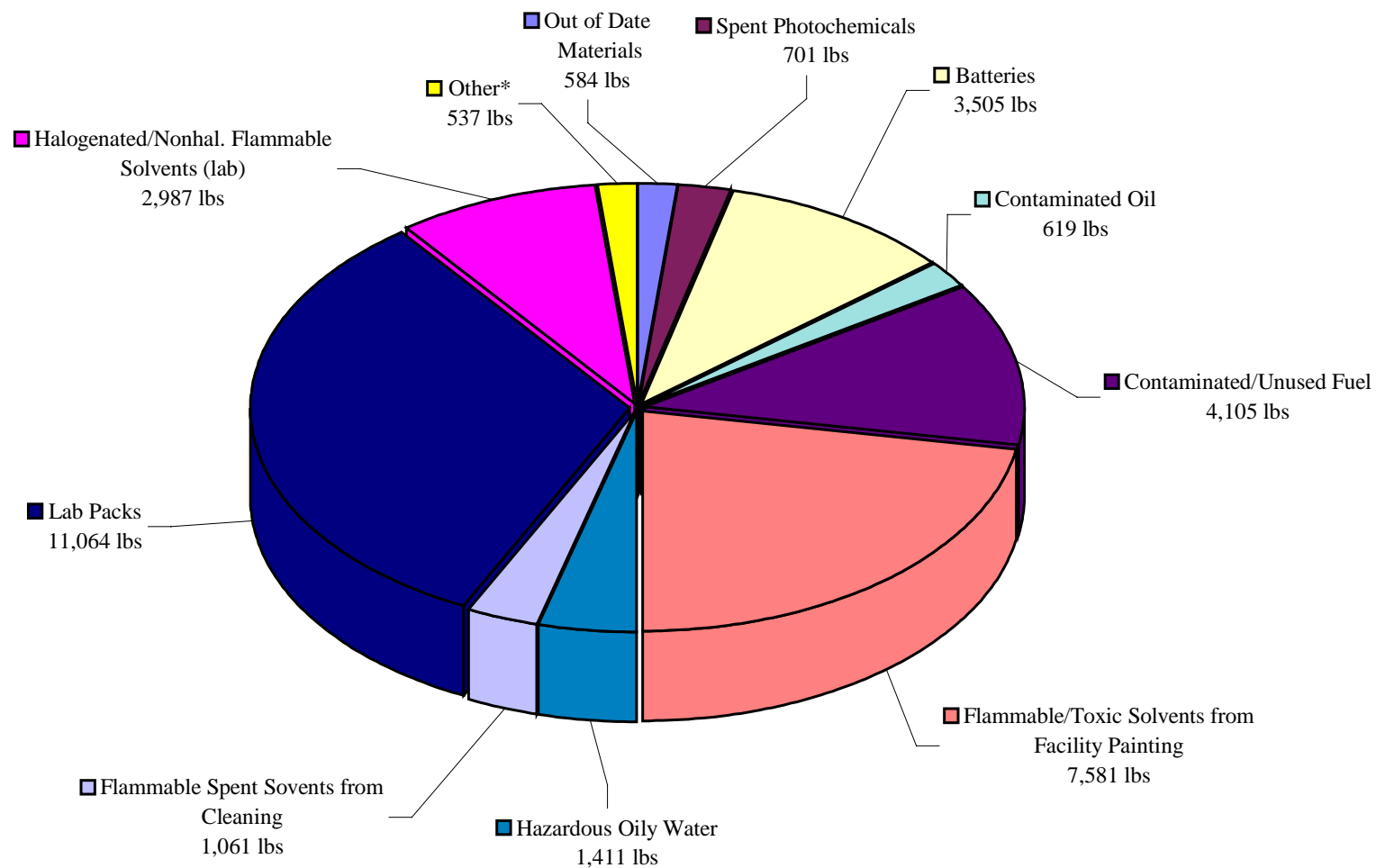


Exhibit E-2
NASA LaRC FY 1998 Hazardous Waste Disposal
Excluding Remediation Waste



*Other wastes include cylinders, halogenated cleaning solvents, and metals from lab research.

Exhibit E-3
NASA LaRC FY 1999 Hazardous Waste Disposal
Excluding Remediation Waste

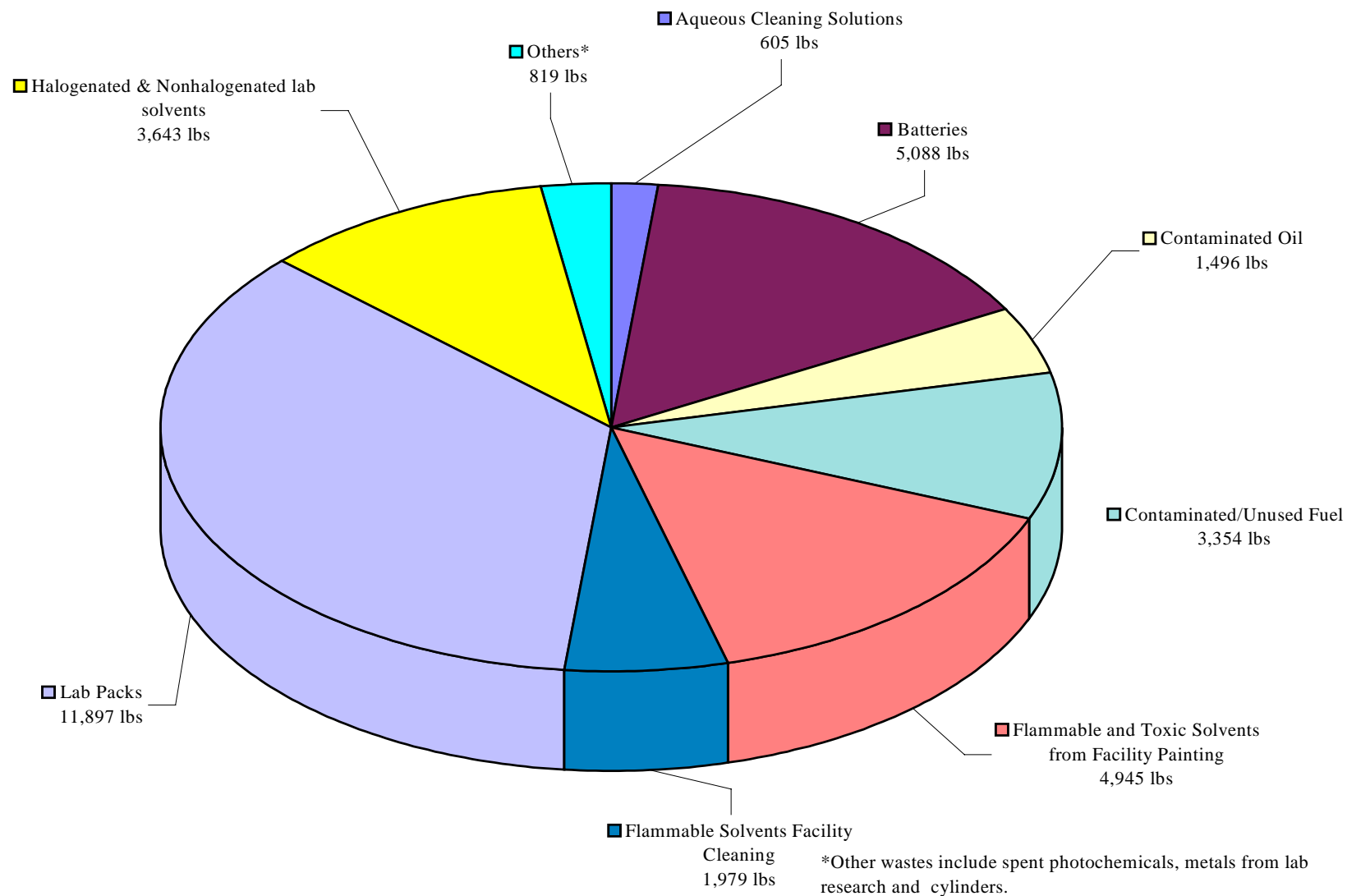
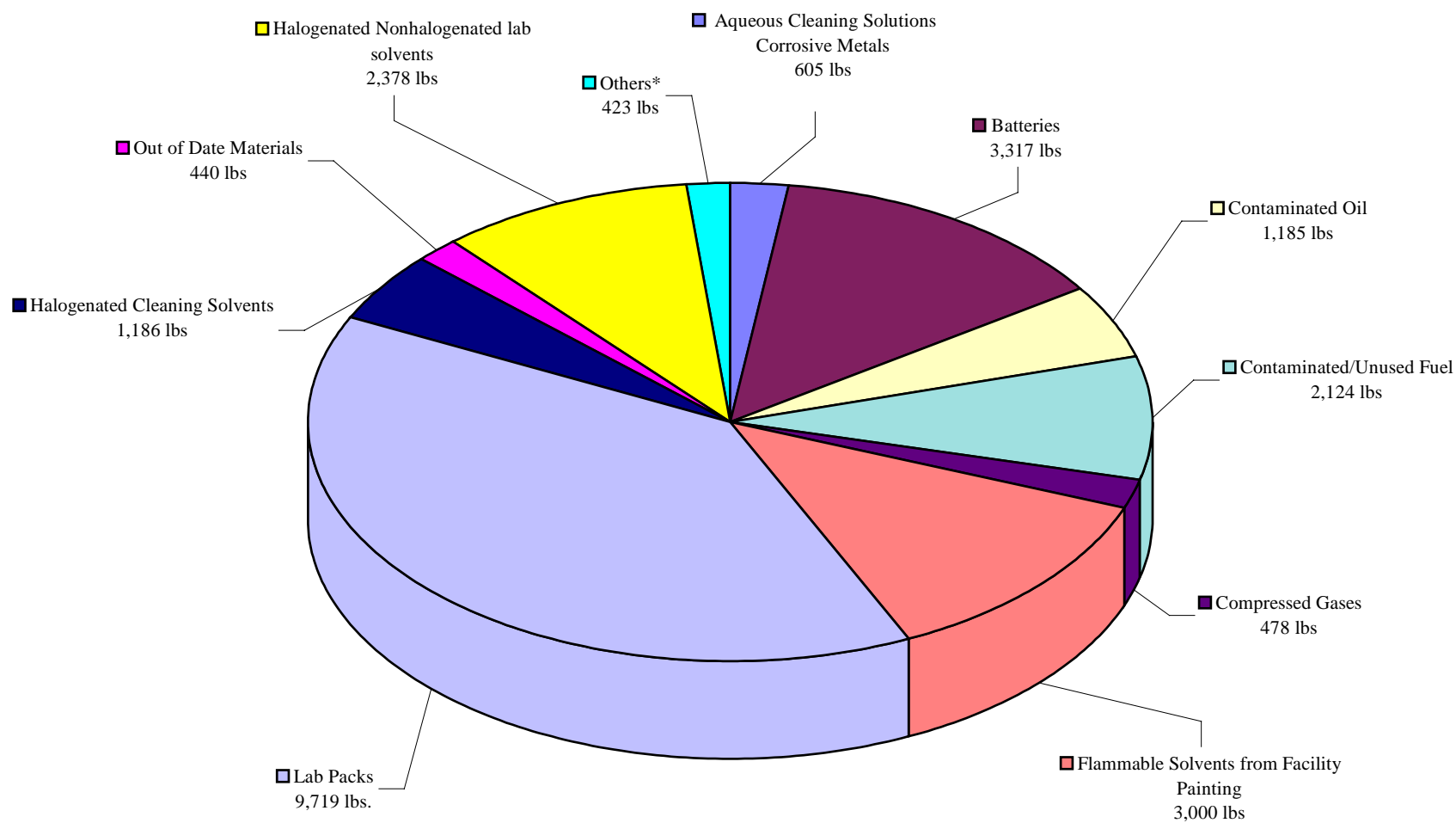
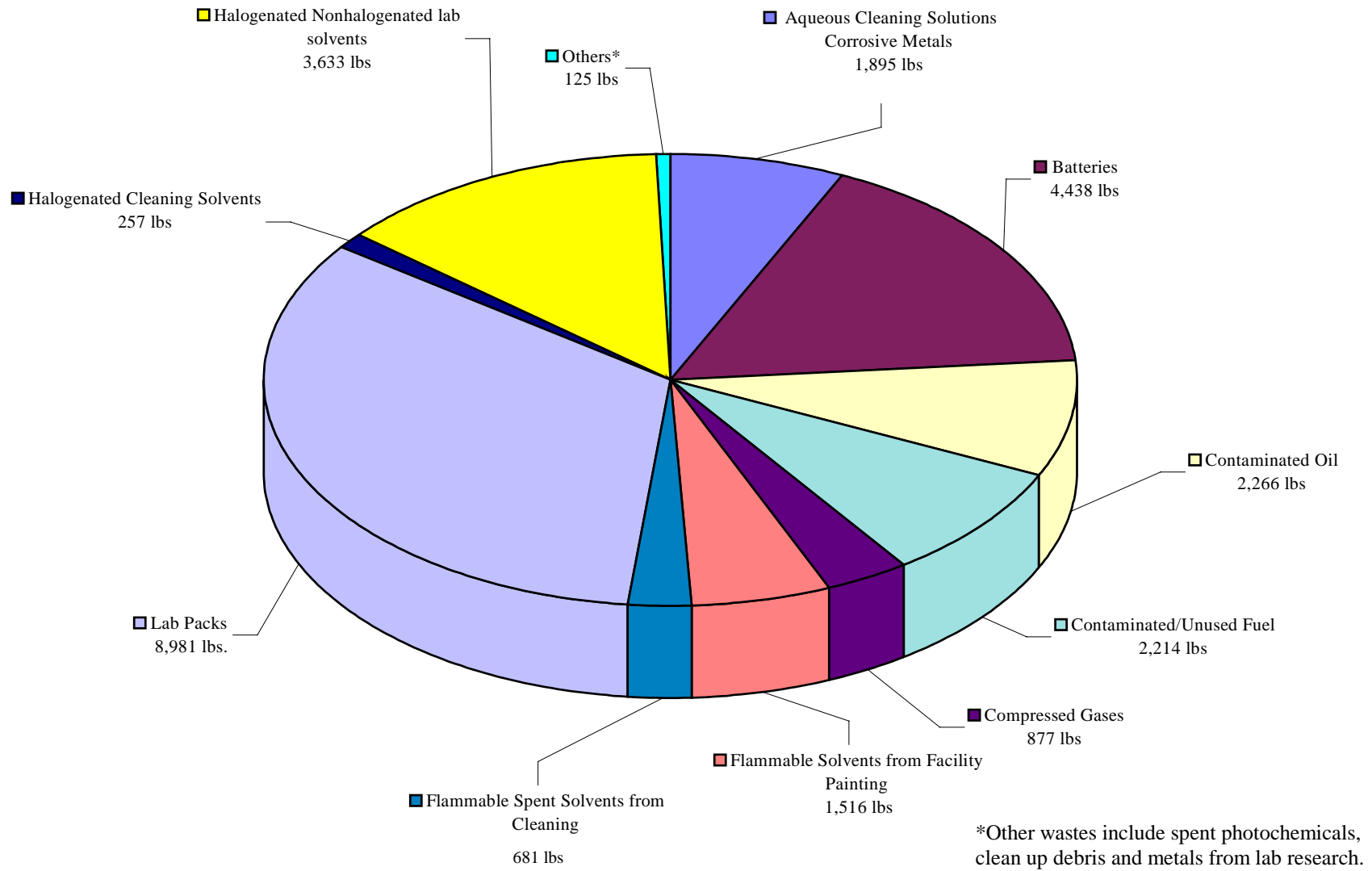


Exhibit E-4
NASA LaRC FY 2000 Hazardous Waste Disposal
Excluding Remediation Waste



*Other wastes include spent photochemicals, clean up debris and metals from lab research.

Exhibit E-5
NASA LaRC FY 2001 Hazardous Waste Disposal
Excluding Remediation Waste



3.0 Nonhazardous and Non- RCRA Regulated Waste Generation Information

As overall waste data has become more detailed over the past several years, it is apparent that the yearly total amount of nonhazardous (NH) and non-RCRA regulated material comprises anywhere from seven to ten times the yearly total of HW. Although NH and non-RCRA waste materials come under less stringent management and regulatory requirements, they are still a very important and large part of the Center's total volume of waste generated. Analyses of the NH and non-RCRA waste data can be used in the same way that HW data is used to identify pollution prevention projects, with the ultimate goal being overall waste reduction.

Table E.4 summarizes the NH and non-RCRA waste generated at the Center for FY 1997 to 2001 and lists total waste both with and without one-time wastes. Waste types are broken down into subcategories to aid in comparison and analyses of trends. The waste streams included in Table E.4 are classified as NH and non-RCRA if they fall into one or all of the following categories: 1) they do not exhibit the RCRA characteristic of ignitability, corrosivity, toxicity or reactivity 2) they are not regulated by the Department of Transportation (DOT), with the exception of Polychlorinated Biphenyls (PCBs) and Asbestos 3) they are regulated by the Toxic Substance Control Act (TSCA), such as PCBs and Asbestos 4) they are not listed by the Environmental Protection Agency (EPA) in 40 CFR Part 261. Please note that the data for non hazardous solid debris material that is not shipped off site in drums is not included in this section. It can be found in the Solid Waste section of this Appendix.

Table E-4
Nonhazardous and Non-RCRA Regulated Waste Generation Summary (pounds of waste)
NASA LaRC FY 1997-2001

Type of Waste	1997	1998	1999	2000	2001
Drum and Lab Pack Material – nonhazardous, non-RCRA/TSCA / DOT regulated solids and liquids (not suitable for rolloff). Shipped for disposal in drums.	68,119	98,737	73,712	47,401	39,161
Asbestos – TSCA-regulated (pipe insulation, coating, tile, mastic, transite panels, adhesives, tar paper, fire brick, lined ovens, file cabinets).	174,000	62,000	40,000	8,251 ²	3,891
PCB Material – TSCA-regulated (light ballasts, capacitors, and small transformers).	1,717	6,823	7,057	6,702	3,018
Non PCB Material – Non TSCA, RCRA, DOT regulated (light ballasts, capacitors).	790	1,390	3,376	2,015	815
Oil/Water Separator Material – low oil content waste, suitable for oil water separation at Building 1181. Turned in as drum material.	69,264	66,267	68,598	100,269	117,280
Soil – High Total Petroleum Hydrocarbon contaminated soil, gravel, debris (from spill / remediation projects). Greater than 1,000 ppm TPH.	0	20,000 ¹	0	12,000 ³	0
Transformer Oil – Non TSCA/DOT/RCRA (drained from transformers; below 50 ppm PCB).	0	38,239	110,230	0	3,600
Bulk Oily/Waste Water – Not suitable for oil water separator, high solids, sludge, high volume, shipped by tanker truck.	0	18,500 ¹	0	0	0
Total – All Nonhazardous and Non-RCRA Regulated Material	313,890	311,956	302,983	176,638	167,765
Total - Without One-Time Shipments	313,890	273,456	302,983	164,638	167,765

The following is a brief analysis of the largest NH and non-RCRA waste streams from FY 1997 to 2001. The percentages are based on the pie graphs (Exhibits E.6-E.10) and are presented in Table E.5.

2001

The Center generated 167,765 pounds of NH and non-RCRA waste in FY 2001. The largest waste stream was Oily Water for Oil Water Separation at 70 percent. This waste was generated mostly from facility maintenance operations such as mopping floors and cleaning and rinsing equipment. The oil water separator can treat liquids that contain less than 40% oil.

¹ One time - oily water from washing tunnel walls at Bldgs. 645 and 1212C.

² Does not include Asbestos disposed of by remediation projects performed by off-site contractors, FY 2000

³ One time - oil spill at Bldg. 1146 in October, 1999.

The second largest waste stream was Drum and Lab Pack Material at 23 percent. This is a 5 percent decrease from last year. The decrease could be attributed to more of the liquid material being able to be processed in the oil water separator. The other categories such as PCB Material and Asbestos represent only a small portion of the year's total waste. In comparison to FY 2000 data, not much has changed.

2000

The total amount of NH and non-RCRA waste generated by LaRC for FY 2000 was 164,638 pounds. This is about one half less than the total for FY 1999. Oily water represented the largest category at 61 percent of the total waste stream. This is almost triple the volume from FY 1999. Much of this waste is generated from the maintenance of old or inefficient equipment, and from processes that cannot discharge wastewater directly to the sanitary or storm sewer because of contaminants. An example of this is the large volume of wastewater that is generated every year by the Metals Cleaning Laboratory at Building 1229A.

Lab Pack and Drum material represented the next largest waste stream at 28 percent. This is an increase in percentage from last year, however, the decrease in total wastes generated resulted in the higher percentage. This category actually decreased in volume by 25 percent in comparison to FY 1999 data. In FY 2000, the Center did not have a major event such as VPP or ISO to cause facilities to do a major cleanout of non hazardous materials. Also, as facility personnel continue to better manage their chemical and product inventories, this waste stream should continue to decrease.

As noted in Table F.4, the total volume of Asbestos waste generated by the Center in FY 2000 does not include Asbestos waste that was removed and disposed of by off-site contractors. Prior to this year, the EMO environmental support contractor was responsible for disposing of the Center's Asbestos waste and tracking the total annual volume generated. Beginning in FY 2000, the Asbestos remediation jobs were "subbed out" and included disposal. The EMO still signs and maintains copies of the disposal manifests for these jobs, however, it is impossible to determine an accurate total weight from the manifests' measurement units (e.g. "cubic yard" and "bag").

1999

In FY 1999, the Center disposed of 302,983 pounds of NH and non-RCRA waste. Transformer Oil represented the largest category at 36 percent of the total waste stream. This is an increase from FY 1998 data. The volume of transformer oil generated is a direct factor of the number of old and large transformers that are drained or replaced each year at the Center. This number should decrease in future years as the new transformers do not require as much maintenance.

Drum and Lab Pack Material represented the second largest category at 24 percent of the waste stream. This figure is down from 36 percent in 1998. The decrease can be attributed to better management practices being performed by Center personnel, waste management training of personnel, and implementation of pollution prevention projects (See Project Nos. 1, 28, and 61). Also, there was a decrease in the number of latex painting operations that were performed at the Center throughout the year.

1998

LaRC disposed of 273,456 pounds of NH and non-RCRA waste in FY 1998 (excluding one-time shipments). NH and non-RCRA drum and Lab pack material represents the largest category, increasing from 22 percent in 1997 to 36 percent in 1998. Part of this is due to the fact that the on-site painting contractor has switched to latex and water-based paint for a large portion of its projects (See Project No. 55 – Paint and Coatings Study). Also, more facility personnel have had waste management training that has encouraged inventory reduction. The Voluntary Protection Program OSHA visit also played a role in the increase of material turned in for disposal. It is important to point out that the largest portion of this waste category was made up of drums of oily water that were too high in sludge to process through the oil water separator at

Building 1181. Increasing awareness and emphasizing waste reduction for maintenance personnel will be important in order to reduce this category.

1997

The Center generated 313,890 pounds of NH and non-RCRA waste in FY 1997. Asbestos was the largest waste stream as there were a large number of abatement projects performed throughout the year.

Table E-5
Percentage of Nonhazardous and Non-RCRA Regulated
Waste Generation - By Waste Stream at NASA LaRC FY 1997-2001
 (Excludes One-Time Wastes)

Non Hazardous and Non RCRA Regulated Waste Disposal Category	1997	1998	1999	2000	2001
Drum and Lab Pack Material	22	36	28	28	23
Asbestos	55	22	13	5	2
PCB Material (capacitors, transformers, ballasts)	<1	2	2	4	2
Non PCB Material	<1	<1	1	1	<1
Transformer Oil	-	13	36	-	2
Oily Water for Oil Water Separation (drummed material)	22	24	23	61	70

Exhibit E-6
NASA LaRC FY 1997 Nonhazardous Waste
And Non-RCRA Regulated Waste Disposal
Excluding One-Time Wastes

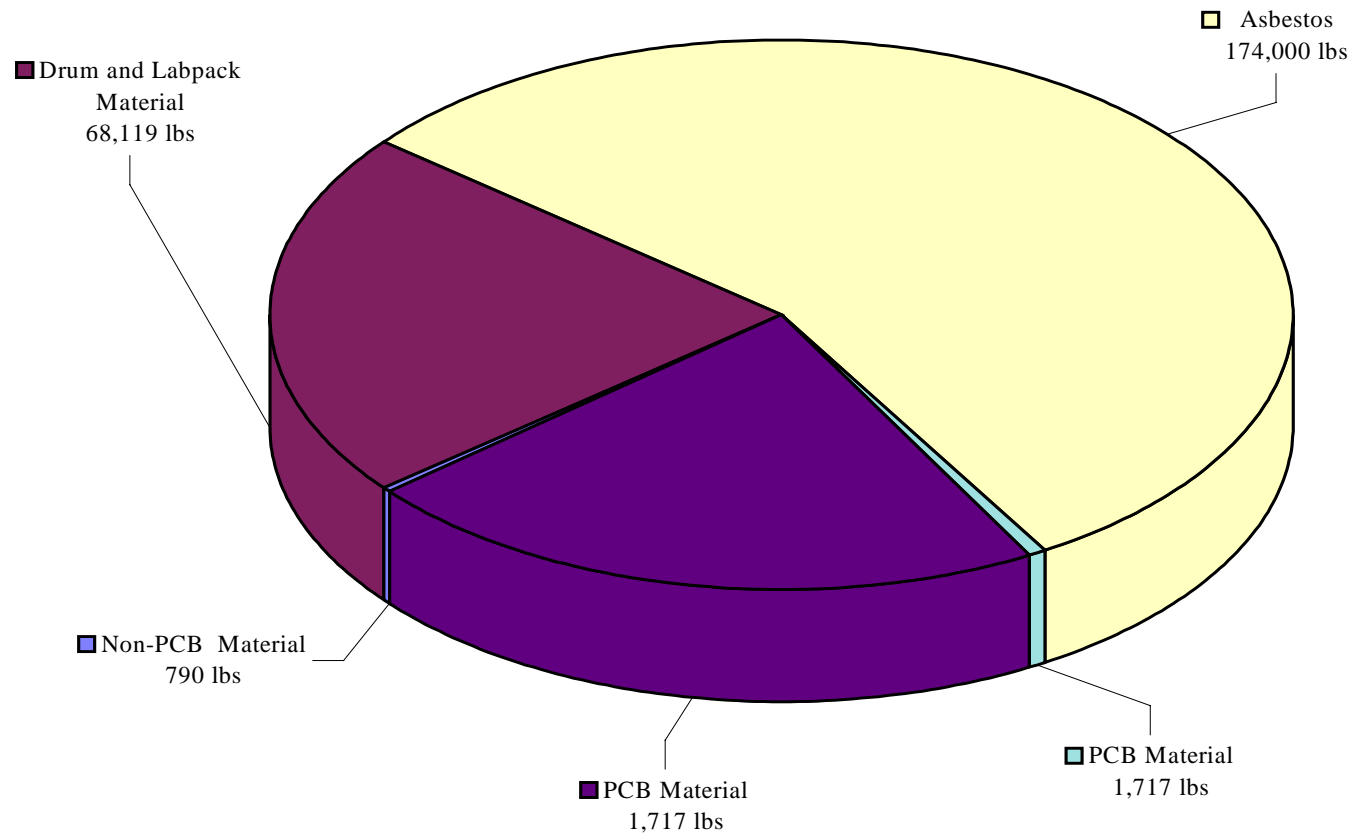


Exhibit E-7
NASA LaRC FY 1998 Nonhazardous Waste
And Non-RCRA Regulated Waste Disposal
Excluding One-Time Wastes

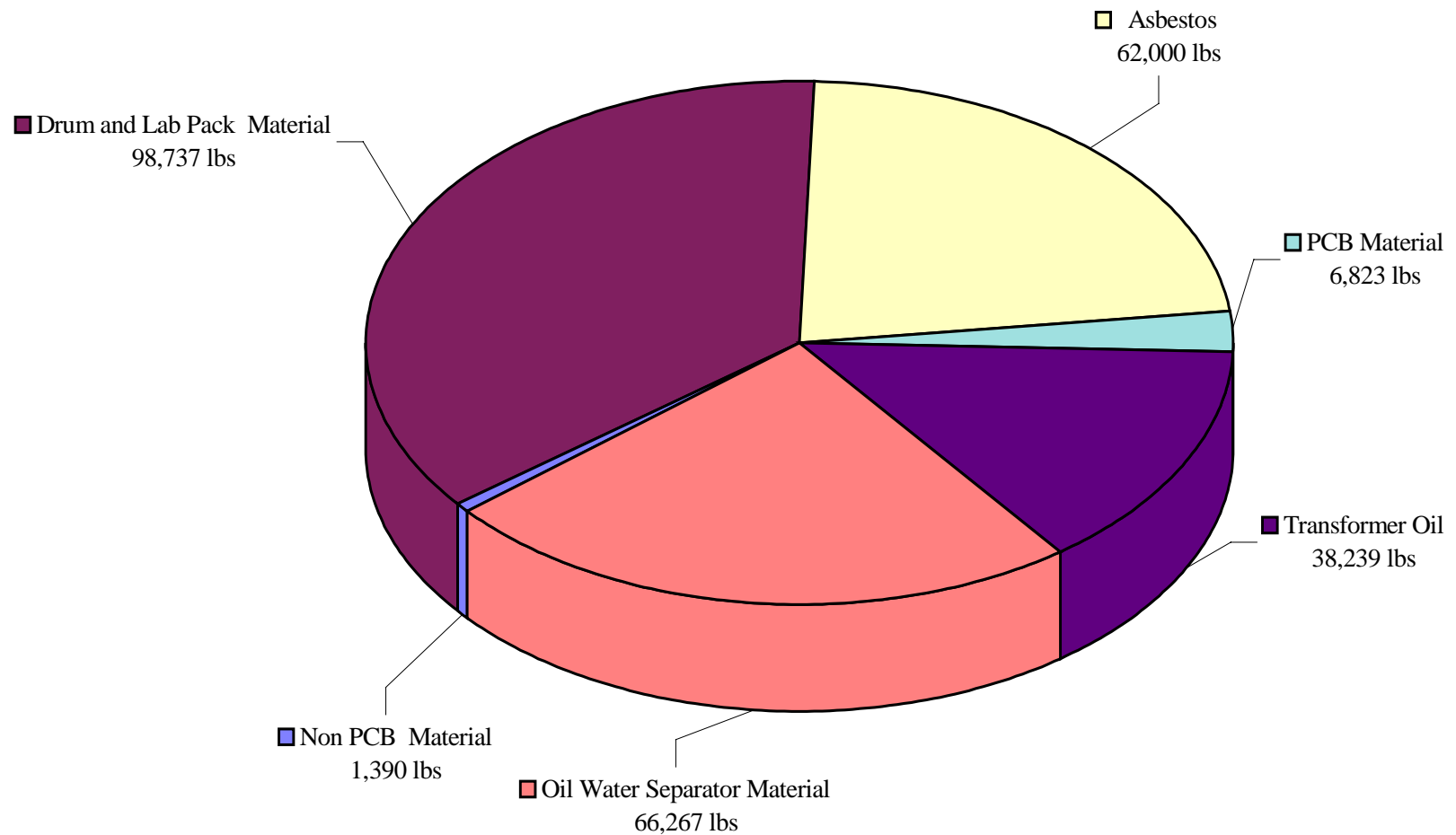


Exhibit E-8
NASA LaRC FY 1999 Nonhazardous Waste
And Non-RCRA Regulated Waste Disposal
Excluding One-Time Wastes

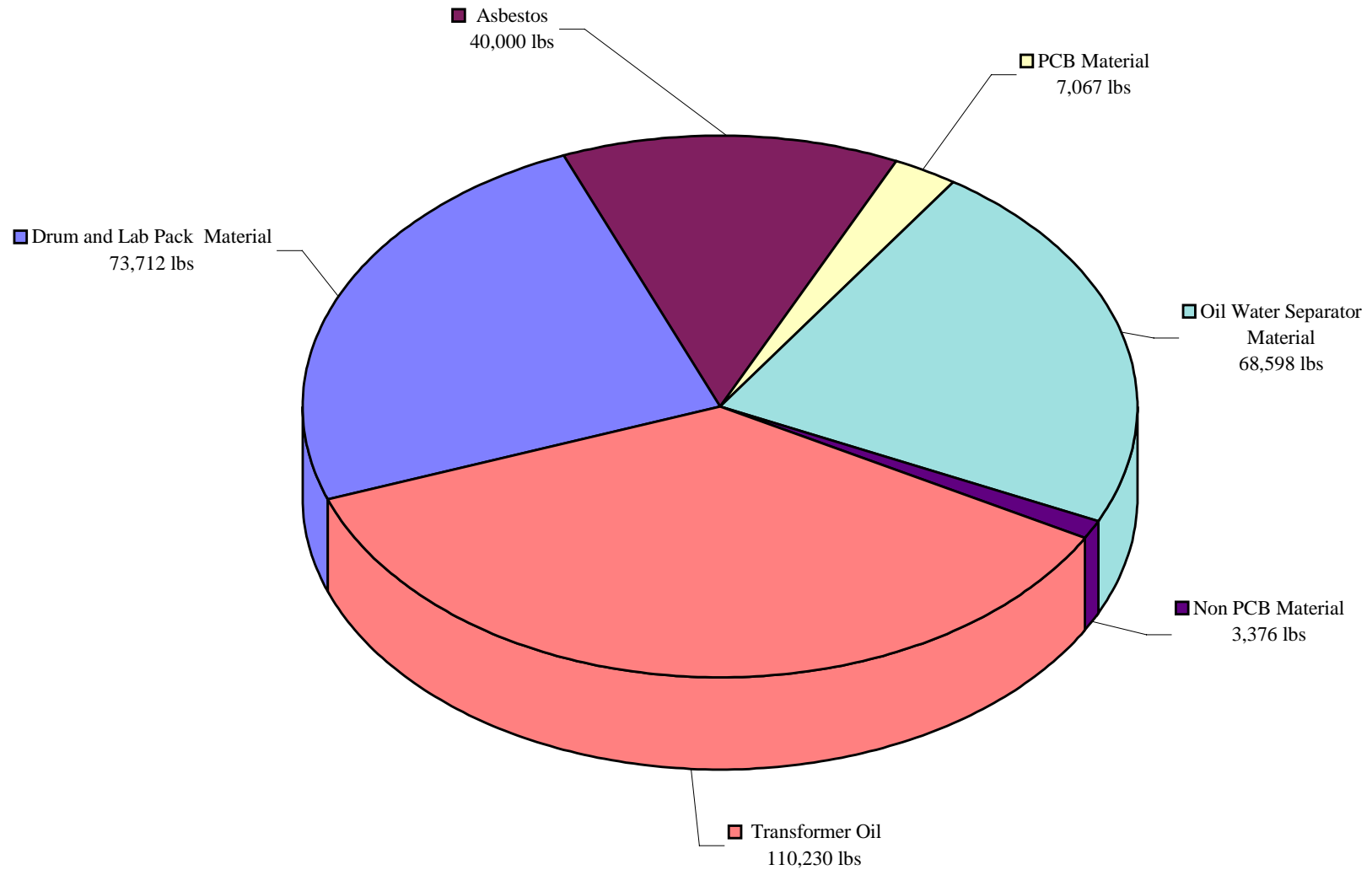


Exhibit E-9
NASA LaRC FY 2000 Nonhazardous Waste
And Non-RCRA Regulated Waste Disposal
Excluding One-Time Wastes

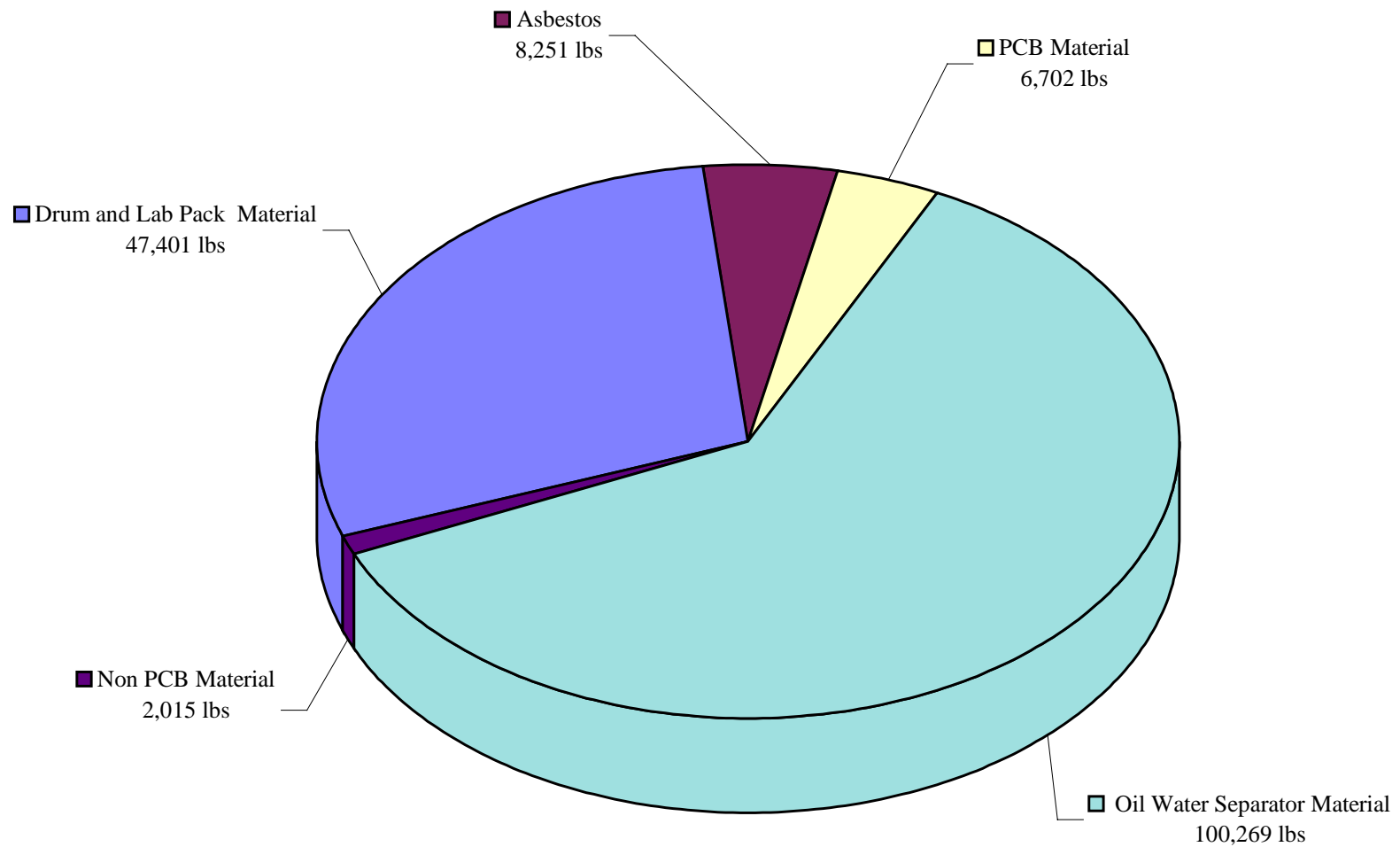
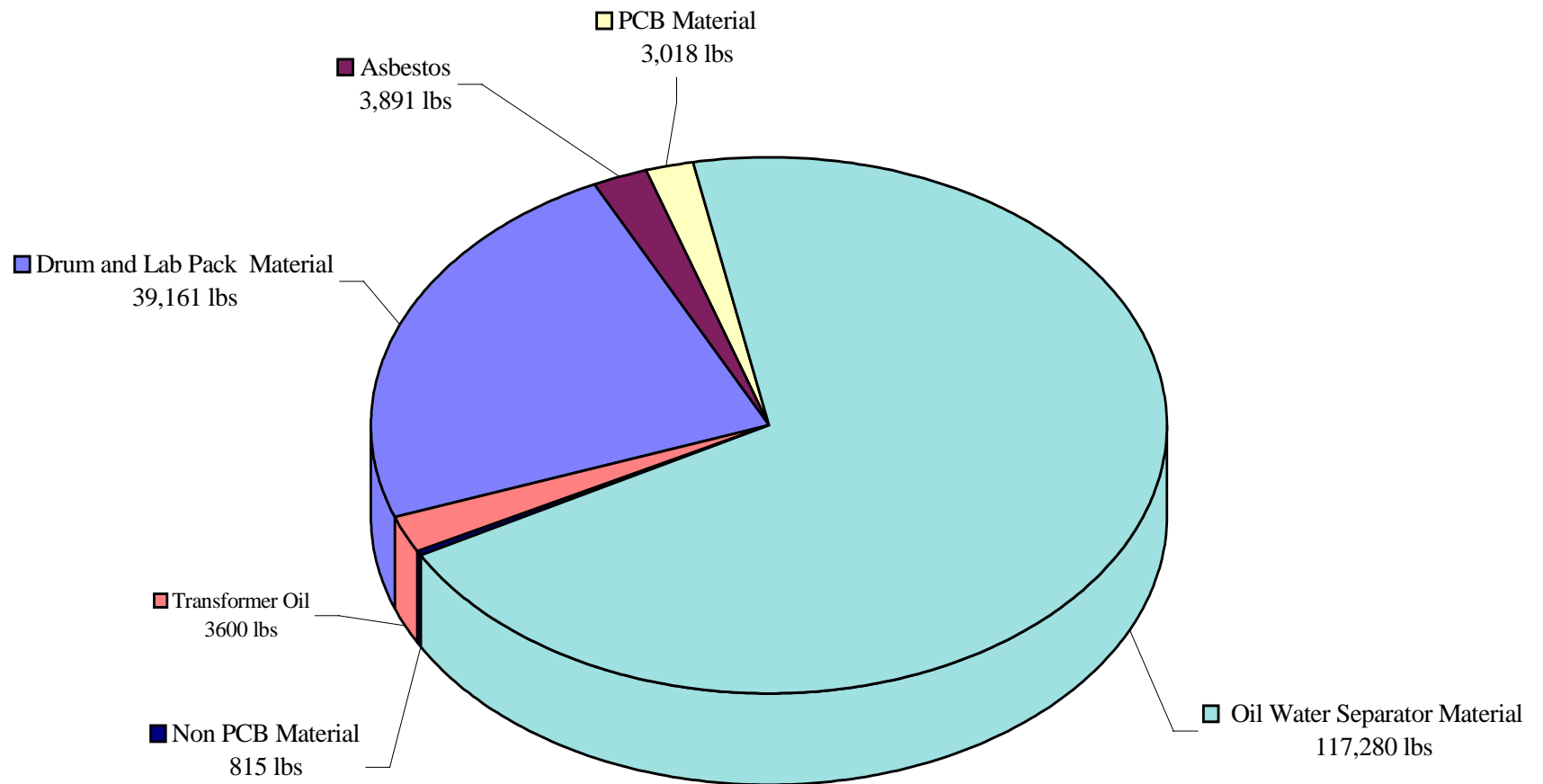


Exhibit E-10
NASA LaRC FY 2001 Nonhazardous Waste
And Non-RCRA Regulated Waste Disposal
Excluding One-Time Wastes



4.0 Solid Waste and Recycling Program

Solid waste is collected for disposal or sent off-site to be recycled. Solid waste is comprised of items such as construction debris, product packaging, furniture, cafeteria wastes, and office waste designated as “trash”. The Office of Logistics Management oversees the daily operation of collecting everyday solid waste. The Environmental Management Office oversees the daily operations of the recycling program. Table E-6 shows the quantity and cost of solid waste disposed for FY97-FY01. Construction and demolition debris is not included in the total solid waste generated for FY97 and FY98.

Table E-6
Solid Waste Generated at LaRC
FY 1997-2001

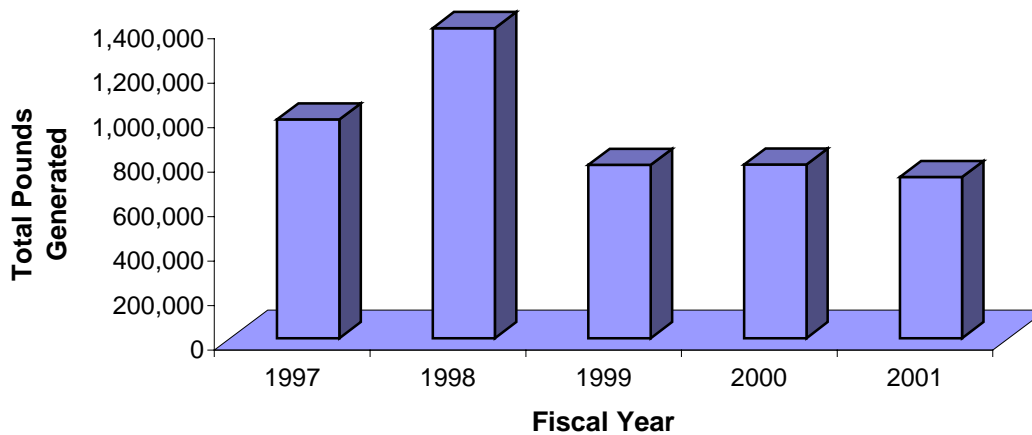
Fiscal Year	Solid Waste (lbs.)	Disposal Cost
FY 1997	1,906,000	\$17,292
FY 1998	3,390,000	\$64,584
FY 1999	8,600,400	\$85,755
FY 2000	8,280,400	\$86,870
FY 2001	7,150,800	\$88,935
Total	29,327,600	\$343,436

NASA LaRC collects various recyclable items that include: aluminum (not aluminum cans), copper, ferrous metals, white and mixed paper, toner cartridges, cardboard, fluorescent tubes, batteries, oil and antifreeze. NASA LaRC also has an active composting program. All shrubs, limbs and leaves are composted. Grass clippings are mulched and left on the ground to act as a fertilizer. Table E-7 and Exhibit E-11 represents the total pounds of material recycled at LaRC from FY 1997-2001.

Table E-7
Materials Recycled at LaRC FY 1997-2001

Type of Material	FY97 (lbs)	FY98 (lbs)	FY99 (lbs)	FY00 (lbs)	FY01 (lbs)
Aluminum	14,960	0	9,050	195	3,410
Antifreeze	2,574	2,145	858	858	858
Batteries	1,718	4,536	9,565	3,230	4,438
Cardboard	57,440	56,280	50,860	49,940	55,980
Copper (incl. copper wire)	0	0	4,242	9,130	4,490
Ferrous Metals	472,380	896,150	397,800	382,980	368,519
Fluorescent Lighting Tubes	6,761	10,388	9,542	10,587	10,254
Mixed Paper	42,600	72,600	60,900	63,840	56,980
Toner Cartridges	1,190	1,789	1,444	1,557	1,441
Used Oil	87,210	98,598	35,440	64,660	31,080
White Paper	296,880	251,900	199,780	193,780	187,360
Total	983,713	1,394,386	779,481	780,757	724,810

Exhibit E-11
Total Pounds of Materials Recycled at LaRC FY 1997 - 2001



Antifreeze

The LaRC Vehicle Maintenance Facility began collecting antifreeze for recycling in October 1994. Starting in February 1994, the collected antifreeze was recycled on-site using a portable antifreeze-recycling unit. In FY01, shop personnel recycled two 55-gallon drums of antifreeze. New antifreeze is used for vehicles that are under warranty because using recycled antifreeze in these vehicles will void the warranty.

Cardboard Recycling

Cardboard collection began in 1996. Currently, there are nineteen facilities designated as large generators of cardboard. Large generator collection bins are collected weekly. Small generators break down boxes and set them next to the paper collection bins. Their cardboard is picked up when the paper bins are emptied. In FY01, LaRC collected 27.99 tons of cardboard.

Scrap Metal (Ferrous Metals and Non Ferrous Metals)

The scrap metal recycling program began in FY 92. During the initial stages of collection, metals were not segregated. Metals were segregated in FY 94 and collection was expanded to include ferrous and non-ferrous metals. The Office of Logistics Management (OLM) oversees the current scrap metal program. The metals are segregated at the facilities and placed in the appropriate bins by the employees. The scrap metal is collected from the facilities by a facility support contractor and transported to the scrap yard for storage. If the segregated metals are contaminated with other metals, it is put in the mixed metal bin, which receives the lowest rebate. The metal is then weighed and sold to a local scrap metal dealer. In FY01, LaRC collected 368,519 pounds of mixed metal, 3,410 pounds of aluminum and 4,490 pounds of copper.

Used Oil

Oil recycling began in 1992. LaRC procures significant quantities of oil and hydraulic fluids. Much of this waste is generated from annual equipment oil changes and the remainder is generated during equipment repairs. LaRC's Facilities and Systems Support Division (FSSD) is responsible for maintaining the hundreds of pumps, generators, and engines at the Center. The LaRC Predictive Testing and Inspection (PT&I) Section started a proactive oil analysis program. This program uses various technologies to detect mechanical wear and electrical problems before equipment breakdown, as well as eliminates unnecessary oil changes (see Project No. 67). Many of the waste oils generated can be recycled if properly segregated. Currently, most of the Center's waste oil meets the criteria for used oil to be shipped off-site for energy

recovery. In FY01, LaRC shipped off-site 4,200 gallons of used oil for recycling.

Fluorescent Light Tubes

The standard fluorescent tubes used throughout the Center contain a significant amount of mercury. The standard 4-foot fluorescent tube contains approximately 22.8 mg of mercury per tube. When tested for disposal, these tubes fail the Toxic Characteristic Leaching Procedure (TCLP) for mercury content and must be disposed of as hazardous waste. The regulatory threshold for the TCLP for mercury is 0.2 mg/l. Over the last 15 years, the fluorescent lighting industry has steadily reduced the amount of mercury contained in fluorescent light tubes. Mercury from these tubes can be recovered for reuse. In FY94, the Center began a fluorescent tube-recycling program to reduce the number disposed of in landfills. In FY01, LaRC recycled 10,254 lbs. of fluorescent light tubes. See Project No. 87 for the history on the Low Mercury Fluorescent Light Tube Program at NASA LaRC.

Toner Cartridges

LaRC began collecting toner cartridges in 1993. Employees box and tag the used cartridges and leave them in the designated areas for pick-up. The toner cartridges are picked-up and transported to Building 1181, the Recycling Facility for storage. The cartridges are then picked up as needed by a contractor. In FY01, LaRC recycled 961 toner cartridges.

White and Mixed Paper

Paper recycling began in 1992. The paper-recycling program was evaluated and redesigned in 1995 and both white and mixed paper is collected throughout the Center. Employees collect paper in various collection containers and place the paper in a centralized collection bin. A contractor collects the paper from centralized bins once a week or as needed depending on the facility. The support contractor transfers the paper from the different facilities to Building 1181, the Recycling Facility. The white paper is baled and the mixed paper is accumulated in Gaylord boxes and then sold to a local paper-recycling contractor. In FY01, LaRC collected 93.68 tons of white paper and 28.49 tons of mixed paper.

5.0 Affirmative Procurement Program

The Environmental Protection Agency's (EPA) Comprehensive Procurement Guideline (CPG) Program is an effort to promote the use of materials recovered from solid waste. Buying recycled-content products ensures that materials collected in recycling programs will be used again in the manufacture of new products.

Congress, under Section 6002 of the Resource Conservation and Recovery Act (RCRA) and Executive Order 13101, authorizes the CPG program. EPA is required to designate products that are or can be made with recovered materials and to recommend practices for buying these products. Once the EPA designates a product, NASA LaRC is required to purchase it with the highest recovered material content level practicable. Exhibit E-12 lists the EPA designated items that NASA LARC must purchase and report data on quantity and costs to the EPA. Section 3.3 details the policy and roles and responsibilities of LaRC personnel in the Affirmative Procurement Program.

Exhibit E-12: EPA Designated Items

Construction Products:

Building Insulation
Carpet
Cement & Concrete Containing Slag
Cement & Concrete Containing Coal Fly Ash
Consolidated and Reprocessed Latex Paint
Floor Tiles
Patio Blocks
Shower and Restroom Dividers and Partitions
Structural Fiberboard
Laminated Paperwork
Carpet Backing
Carpet Cushion
Flowable Fill
Railroad Grade Surfaces/Crossings

Transportation Products:

Channelizers
Delineators
Flexible Delineators
Parking Stops
Traffic Barricades
Traffic Cones

Park and Recreation Products:

Plastic Fencing
Playground Surfaces
Running Tracks
Park and Recreational Furniture
Playground Equipment

Landscaping Products:

Garden and Soaker Hoses
Hydraulic Mulch
Lawn and Garden Edging
Yard Trimmings Compost
Food Waste Compost
Landscape Timbers and Posts (plastic)

Miscellaneous Products

Sorbents
Pallets
Awards and Plaques
Industrial Drums
Mats
Signage
Strapping and Stretch Wrap

Vehicular Products:

Engine Coolants

Lubricating Oil/Motor Vehicle Oil
Retread Tires

Non-Paper Office Products:

Binders (plastic and paper covered)
Plastic Binders
Plastic Clipboards
Plastic Clip Portfolios
Plastic File Folders
Plastic Presentation Folders
Office Recycling Containers
Office Recycling Receptacles
Plastic Desktop Accessories
Plastic Envelopes
Toner Cartridges

Paper and Paper Products:

Printing and Writing Papers
 Reprographic Paper
 Offset Paper
 Tablet Paper
 Forms Bond
 Envelop Paper
 Cotton Fiber Paper
 Test and Cover Paper
 Supercalendered
 Check Safety Paper
Coated Printing and Writing Papers
 Coated Printing Paper
 Carbonless
Bristols
 File Folders
 Dyed Filling Products
 Cards
 Pressboard Report Covers and Binders
 Tags and Tickets
Newsprint
Tissue Products
 Bathroom Tissue
 Paper Towels
 Paper Napkins
 Facial Tissues
 Industrial Wipes
Paperboard and Packaging Products
 Corrugated Containers
 Solid Fiber Boxes
 Folding Cartons
 Industrial Paperboard
 Padded Mailers
 Carrierboard
 Brown Paper

Table E-8 provides the total purchases of EPA designated items, both with and without recycled content. The goal is to purchase all EPA designated products with recycled content, or have an approved waiver that justifies why it does not contain recycled content. There was only one approved waiver in FY00. Section 4 shows a percentage increase in these items purchased with recycled content, however the Center's tracking mechanism is not integrated in the procurement system and therefore may not be accurate.

Table E-8
LaRC Purchases of EPA Designated Items

	FY 1997		FY 1998		FY 1999		FY 2000	
EPA Designed Products	Recycled Content	Without Recycled Content	Recycled Content	Without Recycled Content	Recycled Content	Without Recycled Content	Recycled Content	Without Recycled Content
Construction	\$620,000	\$730,000	-	-	\$16,464	-	\$66,304	-
Transportation	-	-	-	-	-	-	-	\$220
Vehicular	\$400	\$15,852	\$5,200	\$12,480	\$16,043		\$2,708	\$8,916
Paper/Paper Products	\$76,596	\$90,018	\$36,592	-	\$187,271	\$20,551	\$126,480	\$10,797
Non-Paper Office	-	-	-	-	\$22,975	\$31,864	\$44,256	\$12,971
Parks and Recreation	-	-	-	-	-	-	-	-
Landscaping	-	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-
Total Purchased	\$696,996	\$835,870	\$41,792	\$12,480	\$242,753	\$52,415	\$239,748	\$32,904

6.0 Energy Program

In the past, energy conservation at the Center has not been a priority. However, energy consumption has been improved through increased public awareness and the implementation of energy efficiency projects. The low cost of electricity at the Center makes it harder for energy reduction projects to be cost effective. The nature and extent of LaRC's research requires large amounts of energy, many of which are exempt from Federal reduction goals. The Center's Energy and Water Manager is responsible for managing all energy efficiency and conservation management program activities carried out by the Center's Energy and Water Efficiency Team (EET), developing an energy conservation plan, and providing energy consumption data to the EMO. Members of EET include representation from research organizations, engineering, environmental, acquisition, facility maintenance, and the technical sections.

Facilities at the Center fall under the three energy categories given below.

Non-mission Variable Facilities: Facilities that include office buildings, storage buildings, small laboratories and other research and development buildings that are not energy-intensive.

Energy-Intensive Facilities: Facilities that include larger laboratories, research facilities, electronic-intensive facilities, and facilities housing 24-hour-a-day operations that consume energy far in excess of normal energy load requirements. The Center's Steam Plant, the Recoup Facility, and the B1268 complex fall under this category.

Mission Variable Facilities: Facilities, mostly wind tunnels, which are energy-intensive and directly support the Center's research mission. The Center can claim exemption from EO 13123 energy conservation goals for these facilities.

7.0 Water Resources Management Program

The Center's Water and Energy Manager is responsible for managing all water efficiency and conservation management program activities carried out by the EET, monitoring the Center's water usage, identifying conservation opportunities, and providing monthly water consumption data to EMO. The EET suggests opportunities to conserve water. The largest users of potable water at the NASA LaRC are cooling towers, single pass cooling systems, steam ejectors, and the trash burner. The Department of Energy, under EO 13123, requires the Center to reduce potable water consumption by implementing a cost-effective water efficiency program that includes a water management plan and Best Management Practices (BMPs). The Center must achieve at least four of the following BMPs, however LaRC plans to implement all the BMPs. A detailed explanation of the BMPs can be found in NPG 8570.1, "Energy Efficiency and Water Conservation Technologies and Practices."

- Public Information and Education Programs – Educate Center users about water conservation technologies, methods, and successes.
- Distribution System Audit, Leak Detection and Repair – Conduct regular surveys of distribution systems and repair leaks or replace pipes where leaks are found.
- Water Efficient Landscape – Practice water conservation in maintaining Center grounds.
- Toilets and Urinals – Survey toilets and urinals for leaks and retrofit/replacement options.
- Faucets and Showerheads – Survey faucets and showerheads for leaks and retrofit/replacement options.
- Boiler/Steam Systems – Develop and implement a routine inspection and maintenance program to determine opportunities for water conservation for boilers and steam generators.
- Single-Pass Cooling Systems – Inventory cooling equipment and identify all single-pass cooling systems, performing proper maintenance and retrofitting/replacing systems to make them more efficient.
- Cooling Tower Systems – Improve the efficiency of cooling tower systems where feasible.
- Miscellaneous High Water-Using Processes – Determine efficient water use for processes on the Center that require high volumes of water for operation.
- Water Reuse and Recycling – Identify potential opportunities for reuse of nonpotable water.

NASA LaRC's water consumption has decreased significantly over the years—30.5% from FY99, due in large part to the detection and repair of several leaks, and the dissemination of general water conservation information to the facilities. Water usage will most likely continue to decline in FY02. Increased facility personnel awareness has also been helpful in conserving water. In FY00, personnel at the Steam Plant implemented process design changes in order to reuse cooling tower water, which could

save the Center over 3 million gallons of water annually. Table E-9 provides potable water consumption over the past three years. The Center will start conducting water audits in FY02 to determine water consumption of each end user and possible reduction opportunities. Refer to the following pollution prevention projects that promote water conservation for more detail: Water Conservation (Project No. 106) and Beneficial Landscaping (Project No.114).

Table E-9
LaRC Potable Water Consumption (Mgals)

	FY99	FY00	FY01
October	14.1	12.9	14.1
November	16.5	11.6	10.7
December	13.5	9.3	7.3
January	14.4	9.1	8.4
February	14.2	9.9	7.4
March	13.7	11.8	9.7
April	13.8	11.1	8.5
May	16.9	12.5	11.5
June	17.0	16.0	11.5
July	18.9	14.2	13.6
August	16.0	13.8	13.1
September	13.0	12.1	10.6
Total	182.0	144.3	126.4

8.0 Air Quality Program

LaRC is a generator of air pollutants defined and regulated under the Clean Air Act (CAA). The Virginia Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA) regulate air pollution sources at LaRC. The air pollutants from LaRC that are regulated by the CAA are nitrogen oxides (NO_x), sulfur dioxide (SO₂), particulate matter (PM), carbon monoxide (CO), volatile organic compounds (VOCs), ozone depleting compounds (ODCs), and hazardous air pollutants (HAPs).

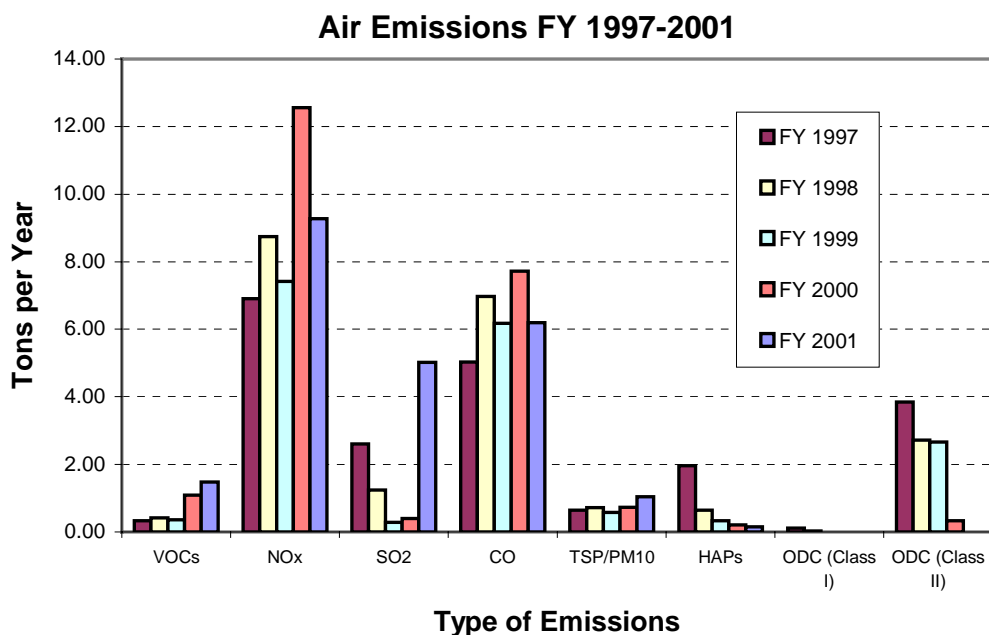
The DEQ issued LaRC a State Operating permit in 2001 that establishes the requirements for complying with the CAA mandates. The permit sets emissions limits for specific stationary air pollution sources as well as center-wide emission limits. The permit also sets operational, record-keeping, and reporting requirements for the Center's air pollution sources.

NASA LaRC is located in an ozone attainment area. This attainment status is based on the current EPA one-hour average concentration standard. In the past several years, there have been several regulatory developments in the area of ozone attainment designations. In 1997, the EPA proposed revisions to the National Ambient Air Quality Standards (NAAQS) for ozone. In the proposal, EPA phased out the one-hour average concentration standard and replaced it with an eight-hour average concentration standard. However, a 1999 federal court ruling blocked implementation of the eight-hour standard and ruled that EPA may not enforce it. EPA has asked the U.S. Supreme Court to reconsider the 1999 court decision. Although the future of the eight-hour ozone standard is uncertain, the Commonwealth of Virginia did evaluate impact of the standard and made recommendations to EPA as to the geographic areas to be designated as nonattainment areas (should the eight-hour standard be implemented). The final decision on the designations and effective date lies with the EPA. It is unlikely that a change in ozone attainment status will impact the air emitting activities at NASA LaRC.

Types and Quantities of Air Emissions

Air emissions data have been derived from fuel usage, operational hours, and stock issue reports. Exhibit E-13 shows the types and quantities of emissions for FY 1997-2001.

Exhibit E-13
NASA LaRC Air Emissions Inventory (1997 – 2001)



8.2 Air Emissions Sources and Activities

The primary sources of NO_x, SO₂, CO, and PM are exhausts from combustion sources such as boilers, furnaces, emergency diesel generators, and combustion tunnels (ex. 8-Foot High Temperature Tunnel). Other combustion sources of emissions include the space heaters, portable air compressors, and mobile sources such as the fleet vehicles. The Arc-Heated Scramjet Test Facility is not a combustion source, however the high temperature airflow produces NO_x emissions.

The primary sources of VOCs and HAPs are paints and solvents used in the paint spray booths and degreasers/parts washers. Other sources of VOCs and HAPs include outdoor architectural painting activities, combustion emissions, fugitive emissions from fuel tanks, and the use of organic solvents, adhesives, and miscellaneous chemicals in the laboratories, research facilities, and maintenance operations.

The primary sources of ODC emissions have been the use of CFCs in wind tunnels, cleaning operations, and air conditioning operations. However, the use of CFCs has been greatly reduced in the past several years. CFCs are still used in a limited number of applications such as the oxygen systems cleaning where no alternative technology has yet been identified (see Project No. 73 – Alternatives to CFC Cleaning of Oxygen Systems).

The sources of air pollutant emissions at LaRC and the pollutant emission limits regulated under the current

air permit are shown in Table E-10.

Table E-10
Major Sources of Air Pollution and Emissions Limits under the State Operating Permit

Source	Emission Limits (tons/year)						
	NOx	SO2	CO	PM	PM-10	VOCs	HAPs
(2) Kaiser Marquardt Sudden Expansion Burners	3.0	-	0.5	-	-	-	-
(2) Cleaver Brooks Boilers	4.7	2.0	10.9	1.0	1.0	0.7	-
(4) Fuel Oil Space Heaters	1.0	3.7	0.3	0.1	-	-	-
(23) Natural Gas Space Heaters	2.2	-	1.9	-	-	-	-
Investment Casting Wax Burn-out Furnace		-		-	-	-	-
CF4 Wind Tunnel Heater System	2.1	-	1.8	-	-	-	-
(3) Babcock & Wilcox Boilers and (1) English Boiler	44.3	34.7	31.5	3.6	3.1	2.0	-
(4) Burners at the National Transonic Facility	1.4	-	6.0	-	-	-	-
(12) Emergency Generators and (8) Fire Pumps	14.4	1.7	3.1	1.0	1.0	1.0	-
Arc-Heated Scramjet Test Facility	3.3	-	-	-	-	-	-
8-Foot High Temperature Tunnel	15.6	-	3.8	-	-	-	-
(15) Degreaser/Parts Washing Units		-	-	-	-	2.3	-
(14) Paint Booths		-	-	0.8	0.8	19.0	15.5
(2) Underground Gasoline Storage Tanks		-	-	-	-	3.2	-
Direct Connect Supersonic Combustion Test Facility	1.5	-	-	-	-	-	-
Combustion Heated Scramjet Test Facility	0.3	-	-	-	-	-	-
Misc. (Blast Booth, Disc Sander, Metal Shop)		-	-	9	9	-	-
Tysman Cross-Cut Saw		-	-	9.7	-	-	-
Acetylene Torch Metal Sheet Cutter	3.9	-	-	13.3	13.3	-	-
Total Facility-Wide Emissions Limits (tons/year):	97.8	42.4	59.7	39	28.7	28.7	15.5

Requirements of the Air Permit

The state air operating permit sets emissions limits for individual air pollution sources as well as facility-wide emissions limits. Other limitations are specified in the permit in addition to the pollutant emission limits shown in Table E-9. The air operating permit also limits visible emissions, fuel types and quantity, operating hours, and the number of test runs for research facilities.

In order to demonstrate compliance with the air permit requirements, LaRC is required to maintain records of all emission data and operating parameters. These records include monthly fuel throughput, number of operating hours and runs, and material throughput. The permit also requires that written operating procedures and maintenance schedules are developed, maintained, and made available to all operators. Detailed emissions records for permitted equipment can be obtained from the EMO.

Appendix F
Environmental Audit Program

Environmental multimedia compliance audits are performed at various buildings and laboratories throughout the Center. The multimedia audits are intended to ensure compliance with Federal or state environmental regulations, Center environmental policy, identify new P2 and training opportunities, establish an environmental profile of each building, and to provide information to FEC's on environmental policies and procedures.

Exhibit F-1 provides the audit checklist and Exhibit F-2 summarizes the audits conducted in FY01, indicating the number of findings and recommendations the facility received in each environmental media area.

Exhibit F-1 **Environmental Audit Checklist**

Building:
FEC Name (Org.):
Auditors:
Inspection Date:
Audit Number:

General Information:

Did the FEC attend mandatory annual training in 2000?

Identify the different processes of the shop/facility.

Chemical Material Tracking System (CMTS)

List CMTS users: Name (Org.) – Phone #

	Yes	No	Comments
Is there a CMTS inventory?			
Is their inventory current?			
Are inventories updated quarterly?			
Do they have inventory records that do not have MSDSs attached?			
Do they regularly use Form 44s?			
Are the product containers closed and labeled?			
Are the raw material storage areas organized and clean?			
The date of the last CMTS log-in that represents inventory changes.			
How does the facility order new products?			
Top Hazardous and Non-Hazardous Materials Used in the Last Year			
Hazardous Material According to CMTS Inventory	Approx. Amount	Process Using Material	
Non-Hazardous Material According to CMTS Inventory	Approx. Amount	Process Using Material	

Pollution Prevention Program

	Yes	No	Comments
Are there active P2 projects in the facility?			
Are there opportunities for P2 projects?			

**Exhibit F-1 (cont.)
Environmental Audit Checklist**

Recycling and Affirmative Procurement Program

	Yes	No	Comments
White / Mixed Paper			
Cardboard			
Toner Cartridges			
Mixed Metals			
Aluminum			
Copper			
Does the facility use 30% recycled content paper?			
Do they currently purchase any EPA designated items?			The list of EPA designated items is attached to the checklist.

Waste Management

Top 5 Hazardous and Non-Hazardous Waste			
Hazardous Waste	Approx. Amount	Process Generating Waste	
Non-Hazardous Waste	Approx. Amount	Process Generating Waste	

	Yes	No	Comments
Are all SAAs identified on EMO master list?			
Are the SAAs at or near the point of generation?			
Are the SAAs clean?			
Have the waste handlers been trained in 2000?			
Is the hazardous waste at the SAAs only generated by this facility?			
Satellite Accumulation Area #1: Location:			
Identify the major waste streams.			
Are the containers closed?			
Are the containers labeled properly?			
Are the accumulated quantities of hazardous waste below 55 gallons?			
Is spill material present?			
Is there a Spill Plan posted?			
Is a weekly inspection on file?			
Satellite Accumulation Area #2: Location:			
Identify the major waste streams.			
Are the containers closed?			
Are the containers labeled properly?			
Are the accumulated quantities of hazardous waste below 55 gallons?			
Is spill material present?			
Is there a Spill Plan posted?			
Is a weekly inspection on file?			

**Exhibit F-1 (cont.)
Environmental Audit Checklist**

Air Pollution Program

Sources	Number	Usage Rate	Materials	Process Purpose
Boilers				
Furnaces				
Generators				
Paint Booths				
Fume Hoods				
Dust Collectors				
Parts Washers				
Gasoline Storage Tanks				
Other				

		Yes	No	Comments / Recommendations
	Are there plans to add, change, modify, or move equipment that would be a potential air emissions source?			If Yes, Explain.
	Are there permitted air emissions sources located in the facility? If yes, answer a-f:			
a	Is a copy of the air permit posted or available at the premises of the permitted source?			
b	Are facility personnel aware of air permit conditions and limits applicable to the permitted air source?			
c	Are the following air permit conditions and limits documented: Fuel type and quantity? Process and operational limits? Materials requirements and limits? Hourly operating limits? Emissions limits?			
d	Are good written operating procedures for the permitted air source and air pollution control equipment maintained and available to all operators?			
e	Are maintenance schedules for the permitted air source and air pollution control equipment maintained and available to all operators?			
f	Have any equipment failures or malfunctions occurred that caused excess emissions for more than one hour?			

**Exhibit F-1 (cont.)
Environmental Audit Checklist**

Water Program

		Yes	No	Comments/Recommendations
	Are there plans to add, change, modify, or move equipment or processes that would be a potential wastewater discharge source?			If Yes, Explain.
	Are there any processes that discharge to HRSD (sanitary sewer)? If yes, answer a & b:			
a	Describe the process discharging to HRSD (include volume/day of discharge if known).			
b	Has the discharge been tested by the EMO? And if so, has the process changed since the test?			
	Are there any processes that discharge to the storm sewer? If yes, answer c & d:			
c	Describe the process discharging to the storm sewer (include volume/day of discharge if known).			
d	Has the discharge been tested by the EMO? And if so, has the process changed since the test?			
	Are there any drains in the facility that are located near chemical/waste storage areas?			
	If so, are the drains plugged?			

Underground/Aboveground Storage Tank (UST/AST) Program

		Yes	No	Comments/Recommendations
	Are there any USTs/ASTs at your facility that store petroleum and/or petroleum based products? If yes, answer a & b:			
a	Are you aware of any problems, leaks or repairs that have been done in the last year?			
b	Are there plans to add, change, modify, or move any tanks in the future?			
	UST Compliance Questions			
	Is leak detection monitoring equipment working properly and records maintained by the facility?			Date of last record.
	Visual inspection of tank(s) and surrounding area.			
	Description of tank(s).			
	AST Compliance Questions			
	Visual inspection of tank(s) and surrounding area.			
	Description of tank(s).			

Conclusion: The noncompliance findings and recommendations are described below.

Exhibit F-1 (cont.)
Environmental Audit Checklist

Items That Must Contain Recycled Content for FY02

The quantity and cost for both virgin and recycled content products for each designated item is reported.

Construction Products:

Building Insulation
Carpet
Cement & Concrete Containing Slag
Cement & Concrete Containing Coal Fly Ash
Consolidated and Reprocessed Latex Paint
Floor Tiles
Patio Blocks
Shower and Restroom Dividers and Partitions
Structural Fiberboard
Laminated Paperwork
Carpet Backing
Carpet Cushion
Flowable Fill
Railroad Grade Surfaces/Crossings

Transportation Products:

Channelizers
Delineators
Flexible Delineators
Parking Stops
Traffic Barricades
Traffic Cones

Park and Recreation Products:

Plastic Fencing
Playground Surfaces
Running Tracks
Park and Recreational Furniture
Playground Equipment

Landscaping Products:

Garden and Soaker Hoses
Hydraulic Mulch
Lawn and Garden Edging
Yard Trimmings Compost
Food Waste Compost
Landscape Timbers and Posts (plastic)

Miscellaneous Products:

Sorbents
Pallets
Awards and Plaques
Industrial Drums
Mats
Signage
Strapping and Stretch Wrap

Vehicular Products:

Engine Coolants
Lubricating Oil/Motor Vehicle Oil
Retread Tires

Non-Paper Office Products:

Binders (plastic and paper covered)
Plastic Binders
Plastic Clipboards
Plastic Clip Portfolios
Plastic File Folders
Plastic Presentation Folders
Office Recycling Containers
Office Recycling Receptacles
Plastic Desktop Accessories
Plastic Envelopes

Paper and Paper Products:

Printing and Writing Papers
 Reprographic Paper
 Offset Paper
 Tablet Paper
 Forms Bond
 Envelop Paper
 Cotton Fiber Paper
 Test and Cover Paper
 Supercalendered
 Check Safety Paper
Coated Printing and Writing Papers
 Coated Printing Paper
 Carbonless
Bristols
 File Folders
 Dyed Filling Products
 Cards
 Pressboard Report Covers and Binders
 Tags and Tickets
Newsprint
Tissue Products
 Bathroom Tissue
 Paper Towels
 Paper Napkins
 Facial Tissues
 Industrial Wipes
Paperboard and Packaging Products
 Corrugated Containers
 Solid Fiber Boxes
 Folding Cartons
 Industrial Paperboard
 Padded Mailers
 Carrierboard
 Brown Paper

Exhibit F-2
Multimedia Audits Conducted in FY01

Building	Date	Non Compliance						Recommendations					
		Waste Management	Water Management	Air Program	Recycling	CMTS	UST/AST	Waste Management	Water Management	Air Program	RAPP	CMTS	UST/AST
1285	9/27/00												
1286		0	0	0	0	2	0	0	0	0	1	0	0
1283	10/23/00	0	0	3	0	0	0	0	0	0	1	1	0
1229A	10/25/00	0	0	0	0	0	0	0	0	0	1	1	0
1236	10/26/00	0	0	0	0	0	0	0	0	0	1	3	0
1265	11/9/00	3	0	0	0	3	0	0	0	0	1	0	0
1205	11/14/00	0	0	0	0	0	0	0	0	0	1	1	0
1247A-D	11/28/00	0	0	0	0	0	0	0	0	0	1	1	0
1200	12/5/00	0	0	0	0	0	0	1	0	0	1	2	0
1271	12/13/00												
1272		4	1	1	0	3	0	0	0	0	1	0	0
1294													
1159	12/14/00	0	0	0	0	0	0	0	0	0	1	3	0
1247E	1/3/01	0	0	0	0	0	0	1	0	0	1	3	0
1146	1/11/01	0	0	0	0	0	0	1	0	0	1	2	0
1297	1/22/01	2	0	0	0	4	0	0	0	0	1	0	0
1212C	1/23/01	0	0	0	0	3	0	1	0	0	1	1	0
582A	2/8/01	0	0	0	0	0	0	0	0	1	1	3	0
1202	2/13/01	5	0	0	0	4	0	0	0	2	1	0	0
1233	2/15/01	0	0	0	0	5	0	1	0	0	1	0	0
1262	2/22/01	0	0	0	0	0	0	0	1	1	1	4	0

Exhibit F-2
Multimedia Audits Conducted in FY01

Building	Date	Non Compliance						Recommendations					
		Waste Management	Water Management	Air Program	Recycling	CMTS	UST/AST	Waste Management	Water Management	Air Program	RAPP	CMTS	UST/AST
1205	3/7/01	0	0	0	0	0	0	0	0	1	1	3	0
1238B	3/8/01	0	0	0	0	0	0	0	0	1	1	1	0
1296	3/13/01	0	0	0	0	0	0	1	0	0	1	0	0
1237A	3/15/01	0	0	0	0	0	0	0	0	0	1	1	0
1148	3/20/01	0	0	0	0	0	0	1	0	2	1	1	0
1275	4/3/01	0	0	0	0	0	0	1	0	0	1	3	0
1237B	4/5/01	0	0	0	0	0	0	0	0	0	1	1	0
1238A	4/10/01	0	0	0	0	0	0	1	0	1	1	1	0
647													
648	4/26/01	0	0	0	0	0	0	1	1	0	1	1	0
1206	5/8/01	0	0	0	0	0	0	0	0	0	1	1	0
1155	5/10/01	0	0	0	0	0	0	0	0	0	1	1	0
1230A-B	5/14/01	1	0	0	0	0	0	0	0	2	1	1	0
1199A	5/22/01	0	0	0	0	0	0	1	0	0	1	1	1
1199B	6/6/01	0	0	1	0	0	0	0	1	0	1	0	0
1188	6/14/01	0	0	0	0	0	0	1	0	0	1	0	0
1198	6/14/01	0	0	0	0	1	0	1	0	0	1	0	0
1250	7/10/01	0	0	0	0	2	0	0	0	0	1	0	0
1292	7/17/01	0	0	0	0	0	0	1	0	0	1	0	0
1232A	7/19/01	0	0	0	0	0	0	1	0	0	1	1	0
1293A	7/31/01	1	0	0	0	1	0	0	0	0	1	2	0

Exhibit F-2
Multimedia Audits Conducted in FY01

Building	Date	Non Compliance						Recommendations					
		Waste Management	Water Management	Air Program	Recycling	CMTS	UST/AST	Waste Management	Water Management	Air Program	RAPP	CMTS	UST/AST
1236	8/7/01	0	0	0	0	0	0	3	0	0	1	4	0
1299	8/9/01	0	0	0	0	0	0	0	0	0	1	1	0
1225	9/6/01	0	0	0	0	0	0	3	0	1	1	2	0
1215	9/18/01	0	0	0	0	0	0	2	0	0	1	2	0
Totals		16	1	5	0	28	0	23	3	12	42	53	1

Appendix G
Draft List of Priority Chemicals

Executive Order (EO) 13148, section 503, requires that a Federal interagency Workgroup develop a list of chemicals used by the Federal Government that may result in significant harm to human health or the environment and that have known, readily available, less harmful substitutes for identified applications and purposes.

EO 13148 states that development of the list shall consider: (1) environmental factors including toxicity, persistence, and bio-accumulation; (2) availability of known, less environmentally harmful substitute *chemicals* that can be used in place of the priority chemical for identified applications and purposes; (3) availability of known, less environmentally harmful *processes* that can be used in place of the priority chemical for identified applications and purposes; (4) relative costs of alternative chemicals or processes; and (5) potential risk and environmental and human exposure based upon applications and uses of the chemicals by Federal agencies and facilities.

Fact sheets and other guidance documents and tools will be prepared by the EO 13148 Workgroup to assist facilities in implementation of the section 503 requirements. Implementation of the reduction requirements will begin in calendar year 2002.

The EO 13148 interagency Workgroup has prepared this draft list of chemicals, applications and associated alternatives that reflect the criteria described above. The draft list was generated from experiences provided by field-level Federal facility personnel. A table of the chemicals and the quantities used by the Center in CY2000 for the designated applications is given below.

Table G-1
EO 13148 Section 503 Chemical List (*revised 11/14/01*) and Amount Used at LaRC by Application

Chemical Name	Proposed Reporting Threshold Limitations	Amount Used in CY00 (lbs.)*	Use	Proposed Limitations/Exceptions	Possible Alternatives (does <u>not</u> include all possible alternatives)
Mercury	0 lbs.	3.32	<ul style="list-style-type: none"> • Temperature and pressure measuring devices (medical and industrial) • Lab Use Switches 	<ul style="list-style-type: none"> • Except where called for in 3rd party specification or certification (ASTM, NIST, EPA) • ONLY for new construction, renovation in facilities and replacement in hardware etc. 	<ul style="list-style-type: none"> • Aneroid manometers-digital and electronic temperature measuring devices • Zinc formalin, sample freeze drying • Electronic thermostats-mechanical switches, ultrasonic and photoelectric sensors
Cadmium	0 lbs.	0.0	<ul style="list-style-type: none"> • Surface coating/plating processes 		<ul style="list-style-type: none"> • Alternative metal coatings, metal disposition, flame coating, limited area painting
Chrome (chromium VI)	100 lbs.	0.0	<ul style="list-style-type: none"> • Surface coating/plating processes 	<ul style="list-style-type: none"> • Exempt plates and dye 	<ul style="list-style-type: none"> • Alternative metal coatings, metal disposition, flame coating, limited area painting
Chlorine (solid and gaseous)	100 lbs.	400	<ul style="list-style-type: none"> • Wastewater disinfection • Biocide in cooling towers 	<ul style="list-style-type: none"> • For new construction and renovations - to be reviewed for feasibility in cases of non-renovation replacement 	<ul style="list-style-type: none"> • Ozone treatment, UV light, chlorine dioxide • Ozone treatment
Silver	100 lbs.	5.05	<ul style="list-style-type: none"> • Photographic operations • Radiography (medical and industrial) 	<ul style="list-style-type: none"> • Calculate number of units or silver recovered. 	<ul style="list-style-type: none"> • Digital photographic processes • Digital computer radiography
Lead	5 lbs.	19.35	<ul style="list-style-type: none"> • Tin/Lead soldering 	<ul style="list-style-type: none"> • Repair and rework operations only. 	<ul style="list-style-type: none"> • Tin copper eutectic, tin silver eutectic

Chemical Name	Proposed Reporting Threshold Limitations	Amount Used in CY00 (lbs.)*	Use	Proposed Limitations/Exceptions	Possible Alternatives (does <u>not</u> include all possible alternatives)
Ethylene Oxide	100 lbs.	275	• Medical/general sterilizer		• Gamma, electron beam radiation, vapor phase hydrogen peroxide, peracetic acid
Methoxychlor	100 lbs.	0.0	•Pesticide/insecticide		• Integrated Pest Management including process changes
Napthalene	100 lbs.	0.0	•Pesticide		• Integrated Pest Management including process changes
Pendimethalin	100 lbs.	0.0	•Pesticide/herbicide		• Integrated Pest Management including process changes
Pentacholobenzene	100 lbs.	0.0	•Pesticide		• Integrated Pest Management including process changes
PCBs	0 lbs.	Not Available	•Insulating material (dielectric fluids in transformers and ballasts)	• "pcb contaminated: 50-499 ppm; PCBs: 500 ppm+; not regulated by TSCA: less than 50 ppm. Inventoried information: transformers, contaminated transformers, capacitors, pcb-containing items & gallons of fluid is reported"	• Early retirement of existing PCB containing equipment

* Quantities obtained through CMTS.

Appendix H

Environmental Regulations and Policies

Federal Acts:

- Clean Water Act and its Amendment
- Clean Air Act of 1970 (CAA) and its Amendments of 1990 (CAAA)
- Resource Conservation and Recovery Act of 1976 (RCRA)
- Hazardous and Solid Waste Amendments (HSWA) to RCRA
- Energy Policy Act
- Toxic Substances Control Act (TSCA)
- Federal Water Pollution Control Act (FWPCA)
- Title III EPCRA and Clean Air Act Consolidated Chemical List
- Emergency Planning and Community Right-To-Know Act (EPCRA)
- Superfund Amendments and Reauthorization Act of 1986 (SARA)
- Occupational Safety and Health Act (OSHA)
- Pollution Prevention Act of 1990

Code of Federal Regulations:

- 29 CFR 1910.120, 1001, and 29 CFR 1926.58

NASA References:

- NPD 8500.1 NASA Environmental Management
- NPG 8820.3 Pollution Prevention
- NPG 8830.1 Affirmative Procurement Plan for Environmentally Preferable Products
- NASA Regulation 1216.307 (i)
- NASA's Environmental Excellence Strategic Plan

Langley References:

- LAPD 8800.1, *LaRC Environmental Compliance, Restoration and Pollution Prevention Program*
- LAPG 1710.12, *Potentially Hazardous Materials*
- The LaRC Environmental Resources Document (ERD)
- LaRC PCB Management and Spill Prevention, Control and Countermeasure Plan

State Regulations:

- Regulations for the Control and Abatement of Air Pollution (9 VAC 5-10 through 170)
- State Water Control Board Regulations 9VAC25
- Virginia Waste Management Board Regulations 9VAC20
- Virginia Department of Environmental Quality Regulations 9VAC15
- Virginia State House Bill 1757

Executive Orders:

- Executive Order 13149, "*Greening the Government through Federal Fleet and Transportation Efficiency*," dated April 21, 2000.
- Executive Order 13148, "*Greening the Government through Leadership in Environmental Management*," dated April 21, 2000.
- Executive Order 13101, "*Greening the Government through Waste Prevention, Recycling and Federal Acquisition*," dated September 14, 1998.
- Executive Order 13123, "*Greening the Government through Efficient Energy Management*," dated June 3, 1999.

- Executive Order 13134, “*Developing and Promoting Biobased Products and Bioenergy*,” dated August 12, 1999.

Other:

- Federal Acquisition Regulation (FAR) Subpart 23.4, *Use of Recovered Materials*
- FAR clause 52.223-8 “Estimation of Percentage of Recovered Materials for Designated Items”
- Recovered Materials Advisory Notice
- Comprehensive Procurement Guidelines

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Appendix I
Environmental Program Contacts

Environmental Program Contacts

Environmental Program

Robert D. Brown (757) 864-3500

Air Quality

Michelle Fraser (757) 864-8520

Water Quality

Jan Benson (757) 864-3320

Wetlands

Jan Benson (757) 864-3320

Hazardous and Non-Hazardous Waste Management

Mason Proctor (757) 864-4232

Waste Pickup/Drum Issue 5-DRUM

Emergency Planning and Community Right-to-Know (EPCRA)

Michelle Fraser (757) 864-8520

National Environmental Policy Act (NEPA)

Jan Benson (757) 864-3320

Chemical Material Tracking System (CMTS)

Michelle Fraser (757) 864-8520

Pollution Prevention

Michelle Fraser (757) 864-8520

Recycling and Non-Hazardous Solid Waste Reduction

Mason Proctor (757) 864-4232

Affirmative Procurement

Michelle Fraser (757) 864-8520

Training

Mason Proctor (757) 864-4232

Underground and Aboveground Storage Tanks

Greg Sullivan (757) 864-3373

Environmental Justice

Greg Sullivan (757) 864-3373

Environmental Restoration

Greg Sullivan (757) 864-3373

Appendix J

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